To craft, by design, for sustainability
Towards holistic sustainability design for developing-country enterprises

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TO CRAFT, BY DESIGN, FOR SUSTAINABILITY:
Towards holistic sustainability design for developing country enterprises

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PhD thesis Delft University of Technology, The Netherlands
Faculty of Industrial Design Engineering
Design for Sustainability Program

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TO CRAFT, BY DESIGN, FOR SUSTAINABILITY

Towards holistic sustainability design for developing-country enterprises

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For my mother and my mother-in-law
Both of you made this possible

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DEFINITIONS

The literature review in Chapters 2, 3 and 4 elaborates on the main thematic areas of this thesis. Several of these areas comprise abstract ideas, which have no commonly accepted definition. Therefore, in these cases, interpretations that best crystallized these concepts were derived from the literature review to serve as reference points for this research. The key definitions for this research are listed here and discussed further in the literature review.

UNSUSTAINABLE: Unsustainable is the antonym of sustainable, essentially meaning "not able to be maintained at the current rate or level" (OxfordDictionaries.com, 2016).

SUSTAINABLE DEVELOPMENT: The most widely accepted and used definition of sustainable development is, development that "meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 47).

HOLISTIC SUSTAINABILITY / SUSTAINABILITY: This research argues that the nature of sustainability as a systemic concept implies it being a holistic construct which is the sum of all of its conceptual subsets including ecological sustainability, social sustainability, cultural sustainability and economic sustainability. While the adjective *holistic* is implicit in the construct of sustainability used as a reference point of this research, the word *holistic* has been used alongside sustainability in parts of this thesis for additional emphasis as a pleonasm. This research defines (holistic) sustainability as "the possibility that humans and other life will flourish on the Earth forever" (Ehrenfeld, 2008, p. 49) through consciously maintaining the balance between different tenets—including ecological, social, cultural and economic ones.

UNSUSTAINABILITY: Unsustainability refers to the state or condition of being unsustainable (Wordnik.com, 2016). It is not the obverse of sustainability; the two are categorically different (Ehrenfeld, 2008, p. 54). Unsustainability is generally tangible and measurable, while sustainability is an aspirational, emergent property of a living system (Ehrenfeld, 2008).

PRODUCTION-TO-CONSUMPTION SYSTEM: A production-to-consumption system includes the "the entire set of actors, materials and institutions involved in growing and harvesting a particular raw material, transforming the material into higher-value products, and marketing those products" (Belcher, 1998, p. 59). A production-to-consumption system includes three dimensions—the physical flow of materials, the set of players whose hands the materials flow through, and the labour and capital involved in these processes (Belcher, 1998).

CRAFT: Craft is a broad, highly contested term, which is more easily described by what it is not, than by what it is. Craft is the antithesis to industrialization; before industrialization, everything was crafted. This research defines craft as a non-industrial production-to-consumption system that encompasses—but is not limited to—products (crafted objects), skills (craftsmanship), producers (craftsperson) (Risatti, 2007), and trades or occupations (craft) (Ihatsu, 2002).

INDUSTRIAL: Industrial broadly means "of, relating to or resulting from industry" (Wordnik.com, 2016). In the context of this research, the term is defined as: of, relating to or resulting from industrialization.

DESIGN: "Design is the act of deliberately moving from an existing situation to a preferred one by professional designers or others applying design knowingly or unknowingly" (Fuad-Luke, 2009, p. 5).

INDUSTRIAL DESIGN: Industrial design is the professional service of creating "products, services and systems conceived with tools, organizations and logic introduced by industrialization" (International Council of Societies of Industrial Design, 2015).

SUSTAINABLE DESIGN: "Theories and practices for design that cultivate ecological, economic, social and cultural conditions that will support human well-being indefinitely" (Thorpe, 2007, p. 13) are collectively called sustainable design.

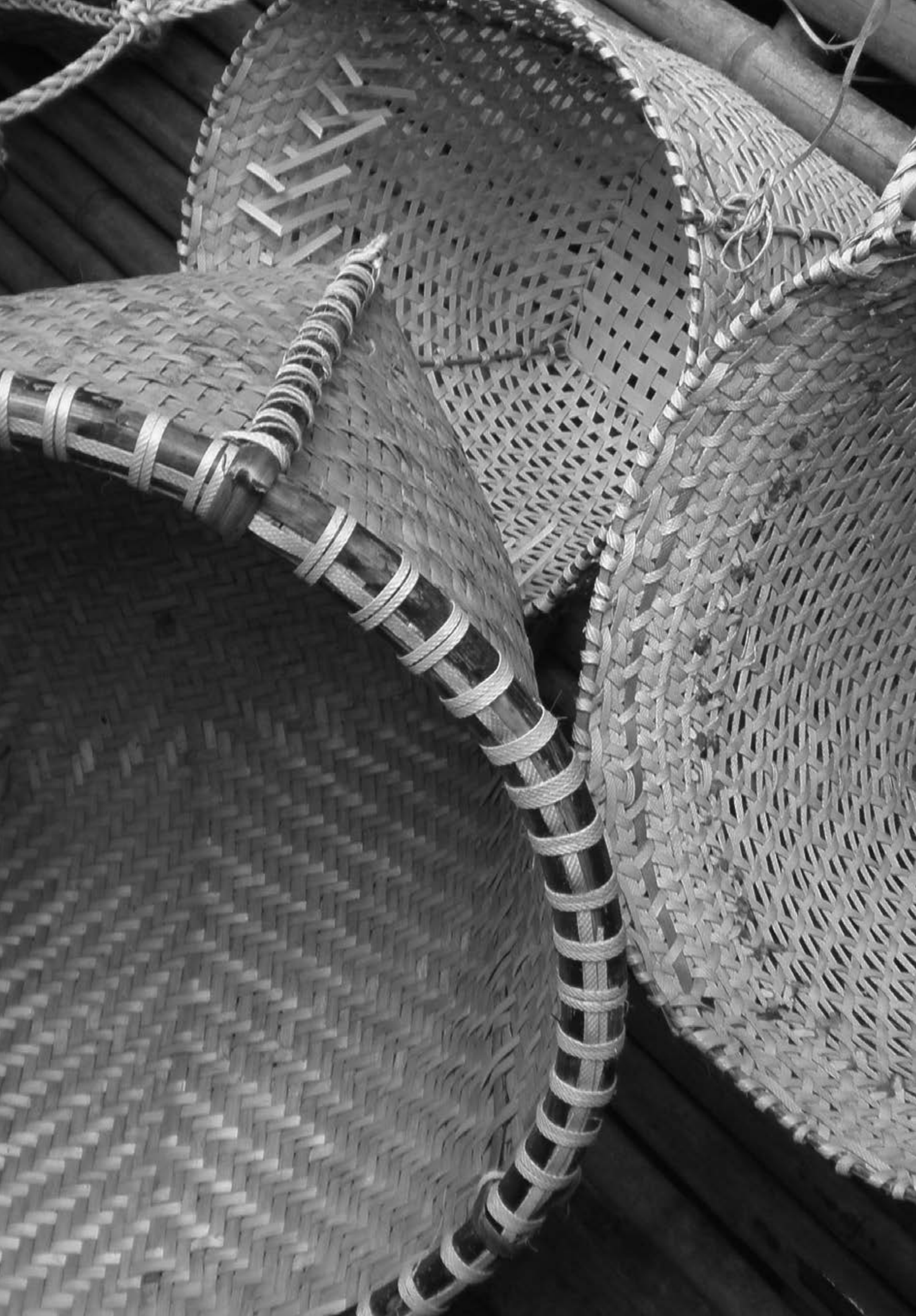
SUSTAINABILITY DESIGN: Theories and practices for design that deliberately actualize the possibility that humans and other life will flourish on the Earth forever (Ehrenfeld, 2008, p. 168), by cultivating a balance between different the different tenets of sustainability—including ecological, economic, cultural and social conditions—are termed as design for sustainability or sustainability design.

INDUSTRIAL MATERIALS: Industrial materials include those commonly produced and processed with the tools and logic introduced by industrialization, for industrial production-to-consumption systems. These include mainstream versions of wood, metal, glass, textile, ceramic and plastic.

NON-INDUSTRIAL MATERIALS: Non-industrial materials include those materials produced and processed with the tools and logic introduced pre- or post-industrialization, for non-industrial production-to-consumption systems. These include non-mainstream materials used for small production batches, including craft materials such as natural fibres, and may also include some exploratory sustainable materials such as recycled Tetra Pak board.

DEVELOPING COUNTRIES: Countries in the bottom three quartiles of the Human Development Index—a composite index of three indices measuring countries' achievements in longevity, education and income—are termed as developing countries (Klugman, 2010).

WORLDVIEW: A worldview is a fundamental set of "presuppositions (assumptions which may be true, partially true or entirely false) which we hold (consciously or subconsciously, consistently or inconsistently) about the basic constitution of reality, and that provides the foundation on which we live and move, and have our being" (Sire, 1976, p. 19).



SUMMARY

Renewable materials such as bamboo, cork and hemp—which are abundantly available in the developing world—have the potential to be a viable and sustainable resource base for sustainable development; especially given that emerging global markets are increasingly aligned to sustainability. Current sustainable-design initiatives and approaches already look at using industrial techniques and technologies to recontextualize these materials to create innovative products and systems for contemporary sustainability-aligned markets. While the resultant design outputs from these initiatives do indeed manage to be more mindful of ecological sustainability and to target sustainability markets, they do not leverage the huge labor force and cultural resources available in developing countries. These products, therefore, bypass the need and opportunity for design to be a vehicle to address sustainability holistically—by going beyond an ecological focus to also consider the social, cultural and economic dimensions of sustainability.

Many of these renewable materials grow abundantly in the developing world, where they are traditionally part of craft production-to-consumption systems. The influx of industrial substitutes in these localized production-to-consumption systems has led to the loss of markets for craftspeople. Consequently, these craftspeople are increasingly vulnerable to eco-, socio-economic, and cultural unsustainabilities—including degraded environments, unemployment, poverty and loss of identity caused by distress migration. If design were to build upon these craft production-to-consumption systems—rather than bypass them to take a mainstream, industrialized technology-push approach—it could go beyond creating products, to orchestrating production-to-consumption systems that are holistically sustainable. The resultant products would be produced using renewable materials (ecologically sustainable), crafted in a labor-intensive manner (socially sustainable), build on craft traditions and indigenous knowledge (culturally sustainable) and target viable sustainability-aligned markets (economically sustainable). This would contribute to holistic sustainability by simultaneously addressing the complex and interlinked social, cultural and economic unsustainabilities—such as poverty and unemployment—in the developing countries where these materials originate and where these products are often produced.

Actualizing this potential calls for alternatives to mainstream, technology-intensive, industrial-design approaches which do not tackle the concept of sustainability in a

holistic manner. These holistic alternatives can ideally generate collective benefits to the ecology, society, economy and culture in the context of developing countries. The objective of this research was therefore, to improve sustainability-design approaches, and thereby practice—especially in the domain of MSMEs working with renewable materials, in developing countries.

THE SPECIFIC RESEARCH QUESTIONS WERE:
RESEARCH QUESTION 1:
To what extent does design address sustainability holistically—simultaneously considering all of its dimensions including social, economic, ecological and cultural dimensions—while working with non-industrial craft-based MSMEs in developing countries working with renewable materials?

RESEARCH QUESTION 2:
What could be a possible sustainability-design approach that is: a) mindful of the pros and cons of the existing sustainability design approaches, and b) which looks at addressing a holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries?

RESEARCH QUESTION 3:
What mechanisms would support and encourage the use and operationalization of any sustainability-design approach that might be developed in response to Research Question 2?

Each chapter in this dissertation is centered on this broad topic along the blueprint of the research design (Chapter 2). Design science research was selected as the research methodology due to its resonance with the broad field of inquiry of this research—sustainability as a *wicked*, multi-dimensional and dynamic problem. Design science research develops and tests solutions in a specific real-world context which represents a larger problem class. It then improves these solutions iteratively such that they are applicable to the larger generalized problem class. This resonated with our aim to improve existing sustainability-design approaches—and thereby practice—in the domain of MSMEs working with renewable materials, in developing countries through practice-based research. The broad stages of this design science research comprised, **1) problem statement**, **2) review of background material**, **3) definition of objectives of a solution**, **4) design and development**, **5) demonstration**, **6) refinement of the final design** and **7) evaluation of the final design**. While this thesis presents these stages in chronological order for clarity, in practice, most of these stages were cyclical and interwoven.

The first step in this research was the framing of Research Question 1, which was important to eliminate the possibility of any presuppositions that existing sustainability-design approaches do not address sustainability in a holistic manner—thereby enabling an objective exploration. This was done through a broad-based literature review, as the domain defined by the research questions is nascent and unexplored. The literature review did not uncover any singular, commonly-accepted definitions for key concepts in this research—including sustainability, development, craft and design. Therefore, we used the findings from the literature review to develop working definitions to serve as reference points for this research.

Most of the literature reviewed focused on single elements or subthemes of Research Question 1. Therefore, the answer to Research Question 1 was collated by posing it in the context of different subdomains—vis-à-vis design approaches and assessment systems, vis à-vis design practice, and vis-à-vis design practice in the area of non-industrial craft-based MSMEs in developing countries working with renewable materials.

We studied and analyzed existing approaches and assessment methods that underpin sustainable-design practice, with regards to how holistically they approached sustainability (Chapter 3). The reference point for holistic sustainability arrived at (Chapter 2) delineated that multiple dimensions—including ecological, cultural, social and economic tenets—need to be considered in order to address sustainability holistically. A comparative analysis of existing approaches and assessment methods vis-à-vis these four dimensions revealed that none of them addressed sustainability holistically (Chapter 3). They all focused on the economic aspect and were eco-centric. The only exception to this was a single category, BoP, which prioritized the social dimension. These findings answered Research Question 1 vis-à-vis design approaches and assessment systems. This was followed by an investigation into the extent to which designers used sustainability approaches and assessments, which revealed that the interest in sustainability and sustainable design has not translated into common practice by designers in either developed or developing countries. This answered Research Question 1 vis-à-vis design practice.

Literature on craft–design interactions in the context of developing countries was reviewed (Chapter 4) in order to zoom in on the specific domain of Research Question 1, non-industrial craft-based MSMEs working with renewable materials in developing countries. The literature review revealed several examples of top–down designer-led approaches in the craft sector, which failed to contribute to the social tenet of sustainability—including the sustainability of craft communities, in terms of their income or social status. Some of these interactions were criticized for eroding the cultural capital of communities, and the ecological dimension was not addressed in most. A few heartening examples where designers translated craft capital into eco-income-generating activities—thereby impacting social, cultural and economic sustainability—were noted. This answered Research Question 1 vis-à-vis design practice in the area of non-industrial craft-based MSMEs working with renewable materials in developing countries.

All of these inputs—including sustainability-design approaches and assessment systems, practice and craft–design interactions in the developing country context—indicate the answer to Research Question 1: Design does not currently address sustainability holistically—considering simultaneously all of its dimensions including social, economic, ecological and cultural dimensions—while working with non-industrial craft-based MSMEs working with renewable materials in developing countries. Existing sustainability-design praxis in general focuses on ecological and economic dimensions although, encouragingly, it appears to be expanding its purview to encompass social and cultural dimensions. In the case of craft-based MSMEs, the design focus and impact seems to primarily be on the economic dimension. Although social and cultural priorities are cited, the extent to which they have been achieved and the means of achieving them are questionable. Existing design practice does not contain examples where design, craft and sustainability have been successfully harnessed together for holistic sustainability. Emerging scholarship and discourse is beginning to recognize design's potential and intention to position craft as a methodological framework, through which to impact and leverage social, economic, cultural and economic sustainability. However, this potential is yet to be realized and the proposed means to realize this are few and far between.

The findings of Research Question 1 were plotted through a conceptual framework (Chapter 5) which offers a diagrammatic insight into the problem context, and an answer to Research Question 1. As indicated by the need to answer research question one in fragments, most of the literature reviewed focused on single elements or subsystems which comprise the conceptual framework. Juxtaposing these components created an information-rich depiction of the complexity of the sustainability design system—especially vis-à-vis craft-based MSMEs in developing countries. The conceptual framework was constructed to illustrate this complexity and, simultaneously, its constituents—including existing and tentatively proposed actors, causal chains and directions. Since the literature review did not uncover a clear or successful approach or method for design to address this scenario, the conceptual framework also proposed a possible way forward—developing and testing such an approach through empirical research, thereby leading into Research Question 2.

Further work on a possible sustainability-design approach required probing into the reasons for which design does not currently address sustainability holistically. A deeper inquiry—through the literature review—uncovered recurrent themes in literature with regards to the barriers to sustainable-design practice (Chapter 3). These are: **1) lack of knowledge about sustainability, 2) lack of holistic overview on production-to-consumption and value chains, 3) failure to include sustainability at a strategic level in the overall approach, 4) failure to include sustainability criteria in the design brief, 5) absence of a collaborative design process, 6) lack of tools,** and **7) failure to keep the design team in the loop during product actualization**.

To answer Research Question 2 on the basis of—and in response to—this, we developed four outputs in the first phase of a two-phase-iteration design-and-development process. The first of these was a construct called the Rhizome Framework, which proposes possible directions for the evolution of traditional craft in the developing-country scenario through design inputs. The second was a methodology towards design–craft collaborations, called the Rhizome Approach, which works towards empowering designers to leverage craft production-to-consumption systems in developing countries for sustainability design—including through the directions outlined in the Rhizome Framework. The third, the Sustainability Checklist, maps a life-cycle approach to a Four

Pillars approach, thereby clearly outlining the criteria desired in the design, and their impact on each tenet of sustainability. The fourth and final output of the first phase of empirical research was the design of an instantiation in the form of a workshop, which would demonstrate and trial the Rhizome Approach and all of its constituents—including the Rhizome Framework and Sustainability Checklist—in the context of the representative problem class.

The Kotwalia community—a traditional bamboo-working community in Gujarat in India—was selected to represent the problem class (Chapter 7). A multi-institution Space-Making Bamboo Craft Workshop (Chapter 10) was conducted in India in 2011, to demonstrate and trial the outputs of the first design-and-development phase of this design science research. The workshop included 24 design participants and 24 craft participants in line with the emphasis of the Rhizome Framework and the Rhizome Approach on collaborative design and craft inputs towards sustainability design. During the workshop, empirical data was collected through various methods, including questionnaires.

One of the main findings of the empirical research was the positive feedback and interest vis-à-vis the Sustainability Checklist used in the workshop. We conducted a validation phase to check the transferability to check whether the findings of the workshop in India were relevant in a proximally similar developing-country MSME setting, and with materials other than bamboo. Our intention was also to use the inputs from this phase for improvement of the Rhizome Approach and its constituents. We assessed the transferability to our problem class through face-validity studies in two different settings from our problem class.

VIETNAM: The first phase was conducted by administering two questionnaires to a group of Vietnamese trainers with a background in sustainable product innovation. The objective was to check whether the overall response to the Rhizome Approach—and especially the positive response to the Sustainability Checklist and feedback on improving it—were similar in India and Vietnam.

WORLD: The second phase was conducted by administering a questionnaire by e-mail to 15 designers located across Africa, Australia, Europe, Latin America, Turkey and Southeast Asia. The questionnaire explored what the respondents thought about the Rhizome Approach and whether they felt there could be complementary, supplementary or alternative steps to make the Rhizome Approach more effective.

Based on the validation of the soundness of our research and also the feedback on the transferability and expected efficacy of the Rhizome Approach from the phase in Vietnam in 2011, we concluded that we had successfully answered Research Question 2: The Rhizome Approach is a possible sustainability-design approach that is mindful of the pros and cons of existing approaches, and which looks at addressing an integrated holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries. This conclusion was supported by the findings from the questionnaire administered to 15 designers around the world in 2016. We therefore proceeded to answer the final research question: What sort of mechanisms can support and encourage the use and operationalization of a possible sustainability design approach developed in response to Research Question 2.

Like most of approaches and tools addressing sustainability in a less or more holistic manner—including LCAs, rules of thumb and checklists—the Rhizome Approach aims to factor sustainability concerns into the product design-and-development process. Our inquiry into why the interest in sustainability and sustainable design has not translated into frequent practice by designers identified seven meta-barriers—only one of which was the lack of tools. The mere existence of tools which aim to address sustainability—such as the Rhizome Approach—does not automatically ensure that sustainability factors will be integrated into the product-development process. Recent literature on sustainability design highlights the importance of *softer* aspects—including organizational structures and systems, and competence building—which are not obviously and directly linked to the product-development-and-design process, but support the implementation and use of sustainable design tools. Research Question 3 therefore centers on mechanisms which can support and encourage the use and operationalization of the Rhizome Approach, and its constituents.

We address Research Question 3 in Chapter 12, where we first study the immediate envelope within which the designer works—the company—in terms of its sustainability journey and sustainability drivers and mechanisms which can influence these drivers. Our literature review revealed four basic instruments: **1) hard regulation, 2) soft regulation, 3) economic instruments** and **4) communication instruments.** The key elements for regulatory instruments to function—including accurate monitoring, a working legal system and transparency—are largely missing in the developing world. Therefore, the driving factor for the developing-world MSMEs in our problem class to invest in sustainability design is, in most cases, the market, rather than existing legislation or financial incentives. Accordingly, the corresponding instruments for this scenario—which could support and encourage the use and operationalization of the Rhizome Approach—are communicative and soft regulation instruments.

We reviewed different types of soft-regulation and communicative instruments; especially the numerous forms of self-regulatory instruments which have emerged over the last decade targeting environmental protection. We selected labeling from among these because it is a third-generation regulatory instrument whose three basic steps—**1) standard-setting**, **2) certification**, and **3) communicating the results of the assessment**—allows it to span the categories of both communicative and soft regulation instruments, and also allows it to span the range between command-and-control regulation and soft, voluntary self-regulation, depending on how strictly it is implemented. In addition, unlike technology-based mechanisms—which target the manufacturing stage by outlining specific processes or technologies to be used—and performance-based mechanisms—which target the output stage by specifying outcomes to be met—labeling is a management-based mechanism which targets the planning stage, which is in line with our argument for front-end innovation which factors in larger sustainability goals.

We tried to identify existing sustainability labeling schemes and labeling schemes in the handicraft sector that could provide an answer to Research Question 3. However, the schemes we reviewed did not address the dimensions of sustainability holistically. Therefore, we decided to develop such a mechanism through empirical research. We selected UNIDO's branding initiative in Vietnam as the platform for this empirical research. The initiative was looking for a way to help the MSMEs it had supported vis-à vis inputs on sustainability, to stay on the track to sustainability, by adding value to, and creating differentiation for, their products through branding. The suitability of using the checklist for this initiative was ascertained in a participatory manner, using some of the exercises we had designed to facilitate the Rhizome Approach in encouraging participation from the stakeholders. We collected the feedback from these participants by questionnaire, using a workshop as the vehicle. In addition, we collected feedback from a second group, comprising the different nodes of the value chain on the same issue. Using this feedback, we refined the checklist and evaluation, and presented the second iteration to a group of stakeholders from the Vietnamese handicraft sector and collected qualitative data from them.

Finally, we offered the final version of our design, called the Holistic Sustainability System, which would work as the mechanism to support and encourage the use and operationalization of the Rhizome Approach and its constituents in answer to Research Question 3. Various options were designed for the graphic representation of the label and the Holistic Sustainability Checklist. These were evaluated through discussions with stakeholders in Vietnam, and also by administering random questionnaires at UNIDO's booth at the LifeStyle Vietnam fair.

The Holistic Sustainability System we developed for UNIDO's branding and labeling initiative leveraged the additional time and cost investment in a holistic sustainability-aligned design process as value-addition and product-differentiation. The outputs of the Holistic Sustainability Checklist were quantified and communicated, thus legitimizing sustainability efforts as credentials. Both of these showed how the investment in sustainability is worthwhile for companies, thus creating a pull for designers to practice sustainability in a holistic manner by using the Rhizome Approach, thereby answering Research Question 3.

Finally, Chapter 13 also presents the conclusions and recommendations of this thesis, aimed at reflectively and coherently tying together pertinent issues covered in the preceding chapters and subsequent findings and learning. All in all, this research—which spanned several diverse and discrete variables, including craft, sustainability, design, and developing countries—aimed to move beyond sustainable design and towards sustainability design. This broad-based field of inquiry was mindful of the fact that the interconnections between variables were as important as the variables themselves, as in any research in the panoptic domain of sustainability. Delimitations which kept the research focused and manageable also inherently defined the domain to which the outputs and findings would be most relevant—namely, the handicraft sectors in Vietnam and India, and bamboo craft in particular.

Several individuals and institutions, apart from those on which this empirical research focuses, have expressed interest in this research indicating a wider audience for the research outputs and findings, and point to research avenues centered on the use and adaptation the research outputs and findings for mainstream sustainability design. We hope that the research findings and outputs, designed to be flexible and adaptable, are extended to a larger problem class and other contexts in the general areas of sustainability and design, and contribute to the larger cause of sustainability design.


HAPOLI

01 INTRODUCTION

This chapter maps the landscape of this PhD thesis. It begins with a brief background (1.1). This is followed by the problem context (1.2), which elaborates on the specific issue at the heart of this research topic—the need and opportunity for design to facilitate holistic sustainability, especially for non-industrial micro, small and medium enterprises (MSMEs) working with sustainable materials in developing countries—and why it warrants special attention. Next, in 1.3, we look at the research objective and research questions. The outline of the thesis is presented in 1.4. The following chapter offers the research design.

1.1 BACKGROUND

The International Network for Bamboo and Rattan (INBAR) is an intergovernmental organization which aims to improve global production-to-consumption systems for bamboo, through its programs on climate change, environmental sustainability, poverty alleviation, sustainable construction and trade and development. INBAR aims to generate equitable incomes from bamboo and rattan, by extending value chains and building stronger partnerships between consumer- and producer-countries through a cross section of approaches, including supporting—and broadening the application of—technological product innovation (INBAR, n.d.). Towards this end, in 2006, INBAR supported Pablo van der Lugt—a PhD researcher from Delft University of Technology, the Netherlands—in studying why bamboo products only have a small market share in the EU, despite the potential of industrially processed bamboo as a fast-growing substitute for hardwood. The resulting report, titled, *Bamboo Product Commercialization in the West—A State-of-the-Art Analysis of Bottlenecks and Opportunities* (van der Lugt & Otten, 2010) indicated that design intervention could aid in a greater acceptability of bamboo in the West. To facilitate this, van der Lugt organized a series of design workshops to encourage Dutch designers to work with bamboo, under the project *Dutch Design Meets Bamboo* (van der Lugt, 2007), as part of his research work. The prototypes developed during the project received positive media attention as eco-friendly designer products, and some were successfully commercialized.

These design-led, industrially-processed, technology-push bamboo products demonstrated that, through design, non-mainstream renewable materials can find commercial viability in sustainability-aligned markets. However, recent studies (Bailly, 2010; Williams, 2007) have questioned the ecological sustainability of these products, given their huge carbon footprint if they are transported from producers in developing countries to markets in developed countries. In addition to perhaps not being as ecologically sustainable as first imagined, these products also failed to leverage bamboo's potential to contribute to social and cultural sustainability by addressing issues of poverty and livelihoods (Lobovikov, Piazza, Ren, & Wu, 2007), which are central to INBAR's development agenda. This is because these products do not translate into livelihoods for indigent bamboo producers in traditional MSMEs in Asia, Africa and Latin America—where a substantial percentage of bamboo production takes place. These communities lack the financial capital to invest in the technology that these product lines require. Therefore, they go from being involved in, and therefore benefitting from, every node of non-industrial bamboo value chains, to having limited involvement in industrial value chains—mostly in growing, managing, harvesting, transporting and processing bamboo at the most primary levels (Fig. 1.1).

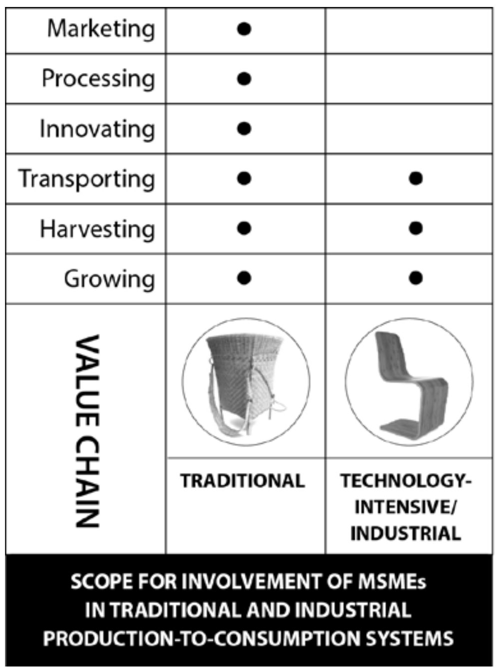


Figure 1.1: Involvement of economically backward producers in traditional and technology-intensive/industrial value chains

This scenario sheds light on the fact that design efforts, even if aligned to sustainability markets and involving green materials, need to go beyond green-design and commercial viability if they are to impact sustainability—including its ecological, social, cultural and economic dimensions—in a balanced and holistic manner. The need to bridge the worlds of development and design, and to facilitate design that actively seeks to impact sustainability holistically in the context of bamboo MSMEs in developing countries, led to the beginning of this research project.

The initial phase of research revealed that the scenario discussed above, and its underlying mechanisms, are not specific to bamboo. They are common to the value chains of several renewable materials—including cork, sea grass, rattan, hemp and jute—especially those used in developing countries with a history of craft production-to-consumption systems. While bamboo remained integral to a large part of the empirical research in this project (because of our background and previous professional association with INBAR), the scope of our research extended beyond bamboo, to encompass production-to-consumption systems based on renewable materials in developing countries with a strong craft tradition.

1.2 PROBLEM CONTEXT

This section discusses the problem context of this research. It begins by examining the importance of renewable materials, and goes on to explore why traditional craft production-to-consumption systems—which often use renewable input materials—are now deteriorating. This is followed by a discussion on why and how design can help sustain traditional craft production-to-consumption systems in developing countries, especially against the backdrop of pressing forms of unsustainability such as poverty and unemployment. Finally, we look at the need and scope for the development of alternatives to mainstream design approaches, in order to address sustainability in a holistic manner in the context of craft and developing countries.

THE IMPORTANCE OF RENEWABLE MATERIALS

The environmental damage caused by over-extraction of materials for human production-to-consumption systems (Thorpe, 2007) has led to serious concerns about the Earth's carrying capacity, and highlighted the importance of renewable materials. Almost three-fourths (70%) of the materials we use post-industrialization—such as coal, natural gas and oil—come from the lithosphere (Thorpe, 2007). These materials take millions of years to form and are therefore considered *non-renewable*, as opposed to resources from the biosphere, which take a comparatively shorter time to regenerate, and are therefore *renewable* (Thorpe, 2007). Therefore, a key rule of thumb in sustainability design is to use renewable input materials (Crul & Diehl, 2006) from the biosphere—such as wood, cotton, linen, hemp and bamboo.

THE DECLINE OF TRADITIONAL PRODUCTION-TO-CONSUMPTION SYSTEMS FOR CRAFT BASED ON RENEWABLE MATERIALS

Renewable resources from the biosphere—such as grasses and other natural fibers, vegetables and fruits such as coconuts and squashes, and animal-based materials such as leather and sea shells (Risatti, 2007)—have traditionally been used as input materials for craft-based production-to-consumption systems around the world, due their easy availability in the natural environment. Jaitley (2001, p. 14) states that craftspeople spanning several categories—including "the skilled master craftsman, the wage worker, the fully self-employed artisan, the village artisan producing wares for local use, the part-time artisan whose craft activities supplement his meager earnings from the land, and the landless artisan—have historically been, and still are, employed in crafting these materials into products for the use of their own communities or for trade and export."

Post-industrialization, craft-based production-to-consumption systems—and the craftspeople integral to them—have been jeopardized by the influx of nationally and internationally produced industrial products, which have captured their market segment. These products have entered their traditionally closed economies (Jaitley, 2001) as a spin-off of the industrial revolution and the information revolution, each of which has impacted access and reorganized economic activity (Humbert, 2007) across the world. The physical and virtual connectivity of the information revolution has exposed consumers in developing countries—including rural buyers—to globalized lifestyles, to which they now aspire. This preference for technology over tradition (Chaudhary, 2010), and for mass-produced substitutes over craft products, has disrupted traditional localized production-to-consumption systems, resulting in a loss of livelihoods for traditional producers in developing countries—thereby contributing to poverty and unemployment.

The unsustainability of livelihoods for craftspeople, given their lack of economic or productive skills, assets and options apart from craft, has led many indigenous craftspeople to migrate to urban areas in search of wage labor (Reubens, 2010a; Society for Rural, Urban and Tribal Initiatives, 1995). This causes unsustainability on several levels. Several crafts have either vanished or are declining, and the pressure caused by mass migration and unprecedented urbanization (Craft Revival Trust, 2006) makes it difficult to even imagine the possibility of sustainable development for all.

THE OPPORTUNITY AND NEED FOR DESIGN VIS-À-VIS SUSTAINING CRAFT-BASED PRODUCTION-TO-CONSUMPTION SYSTEMS

Globalization, the information revolution and unprecedented development—the same constituents which contributed to the unsustainability of craft-based livelihoods—offer new market opportunities for products crafted by communities (Ihatsu, 2002) in the growing demand for sustainable products (Potts, van der Meer, & Daitchman, 2010). These markets are expanding faster than markets for conventional products, and are increasingly embracing initiatives that factor in a wider spectrum of sustainability criteria—including ecological, social and economic considerations (Potts et al, 2010).

However, despite being ideally positioned to do so, economically backward craft producers are unable to access and navigate these markets for sustainable products, to which developed and organized regions have privileged access (Potts et al, 2010). This is due to the fact that these markets and their mechanisms are unfamiliar to craftspeople, since—unlike in traditional craft production-to-consumption systems—there is no direct link between the producer and the buyer in globalized production-to-consumption systems. This link was severed during the process of industrialization, when industrial concepts such as standardization and economy of scale heralded the need to divide the integrated craft-based production-to-consumption process into specialized disciplines (Dormer, 1997)—including design, production and marketing—to increase the productivity of each process, in line with the new concept of division of labor (Cusumano, 1991).

In contemporary globalized value chains, craftspeople are able to function as producers, but there are several gaps which need to be filled with supplemental players in the value chain: actors (who directly produce, process, trade and own the products), supporters (who don't deal directly with the product but whose services add value to the product), and influencers (who create and moderate the regulatory framework, policies, infrastructure, etc., at the local, national and international level) (Roduner, 2007). These value-chain actors, supporters and influencers can help bridge the gap between craftspeople and sustainability-aligned markets.

Designers, who have traditionally functioned as the bridge between production and marketing, are ideally positioned to bridge the gap between craftspeople and sustainability-aligned markets. The design skill set equips designers with the skills and tools to envisage distant scenarios and innovate accordingly, a skill lacking in most craft-producer communities. Design is also able to internalize industrial concepts such as batch production, productivity and quality checks, needed to maintain these markets. For these reasons and more, designers can be instrumental in enabling craftspeople to leverage sustainability-aligned markets, and thereby sustain their livelihoods.

WHY EXISTING DESIGN INITIATIVES FOR RENEWABLE MATERIALS OVERLOOK THE CRAFT–LIVELIHOOD ISSUE

Emerging design initiatives and approaches already look at leveraging sustainability-aligned markets, including in the context of developing countries. Several of these initiatives have an ecological focus (Reubens, 2013b), and look at recontextualizing renewable materials—including those traditionally used in non-industrial craft production-to-consumption systems, such as cork and bamboo—using industrial techniques and technologies, to create innovative products and systems for sustainability-aligned markets. While the resultant designs contribute to ecological sustainability, they miss out on the chance to address complex and interlinked social, cultural and economic unsustainabilities—such as poverty and unemployment—in the developing countries where these products are produced; thereby bypassing the need and opportunity for design to be a vehicle to address the social, cultural and economic dimensions of sustainability alongside its ecological aspect.

In order to address the many layers of sustainability in the context of developing countries, design needs to facilitate production-to-consumption systems that are underpinned by technologies which have a high potential for employment, are not capital-intensive, and are highly adaptable to social and cultural environments (Jequier & Blanc, 1983). To do this, design needs to challenge mainstream, technology-intensive industrial-design approaches, which do not tackle the concept of sustainability in a holistic manner (Maxwell, Sheate, & van der Vorst, 2003). This is easier said than done, as the design–industrialization bond is deeply rooted; the discipline of design emerged as a result of the process of industrialization, and therefore inherently aligns to industrial logic and philosophies. This highlights the need for further research on alternatives to mainstream design approaches; alternatives which generate collective benefits to the ecology, society, economy (Maxwell et al, 2003) and culture in the context of developing countries.

Our study focuses on this underexplored area of research. The following section will introduce the research objective and research questions of this PhD research.

1.3 RESEARCH OBJECTIVE AND RESEARCH QUESTIONS

Design for and in developing countries can be instrumental in realizing a holistically sustainable vision of development, which rests on economic development with a simultaneous increase in socially desirable phenomena (Lélé, 1991), and which is also mindful of ecological and cultural aspects. Design has already been able to align the renewable raw materials available in developing countries with sustainability markets—including by using industrial processing to reconstitute these materials into new avatars. This research argues that though these new designs capitalize on sustainability markets, they do not leverage the huge workforce and cultural resources available in developing countries. Nor do they realize design's potential to orchestrate production-to-consumption systems which contribute to sustainability in a holistic manner, by simultaneously addressing its social, cultural, economic and ecological dimensions and the interlinkages between these.

The objective of our research was, therefore, to improve sustainability-design approaches, and thereby practice—especially in the domain of MSMEs working with renewable materials in developing countries. The main research questions emerging from the statement of the research objective are as follows:

RESEARCH QUESTION 1: To what extent does design address sustainability holistically—simultaneously considering all of its dimensions including social, economic, ecological and cultural dimensions—while working with non-industrial craft-based MSMEs in developing countries working with renewable materials?
RESEARCH QUESTION 2: What could be a possible sustainability-design approach that is: a) mindful of the pros and cons of the existing sustainability design approaches, and b) which looks at addressing a holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries?
RESEARCH QUESTION 3: What mechanisms would support and encourage the use and operationalization of any sustainability-design approach that might be developed in response to Research Question 2?

The primary research objective is to improve sustainability design practice so that it better addresses sustainability holistically (Research Question 3), especially in craft scenarios in developing countries. This question is underpinned by the existence of a sustainability-design approach that better addresses sustainability holistically (Research Question 2) and is mindful of existing scholarship and practice in this regard (Research Question 1).

The predominant question implicit in all of these interconnected inquiries is, *How?* This research objective is based on the assumption that current design approaches—especially those being used in the context of craft scenarios in developing countries—do not facilitate holistic sustainability that demonstrates due consideration for all of sustainability's dimensions. To determine the extent to which this hypothesis is true, the first step will be to understand *what exists*—to what extent current design approaches to achieve sustainability address the topic holistically (Research Question 1). Understanding *what exists*—including *why* and *how* it occurs—was done through the literature review, the scope of which will be defined by Research Question 1. This step is important to avoid the possibility of inadvertently duplicating, in part or whole, an existing praxis by reinventing the wheel in the second step, i.e., the proposed design. Understanding *what exists* is also an inherent part of the main inquiry, which aims to design and develop an artifact that proposes *how* to improve *what exists*. Thus, Research Question 2 will be guided by the findings of Research Question 1, in the context of specific and bounded real-world settings. Research Question 3 will then look at *how* to operationalize the output of Research Question 2.

We expect that alternatives to non-industrial design approaches will take a systemic and integrated route and, therefore, be able to facilitate holistic sustainability—especially in the case of MSMEs working with renewable materials in developing countries. The proposed alternative systemic approach will be designed and developed based on a study of relevant scholarship in literature (theory) in combination with our experiences in developing countries (practice). In addition, tools, methods and other mechanisms will be designed, as required, to operationalize the proposed approach.

1.4 OUTLINE OF THESIS

This research consists of 13 chapters. Figure 1.2 provides a blueprint for the stages and chapterization of our research.

Chapter 1 introduces the background to this research, the problem context, the research objective, and the research questions.

Chapter 2 discusses the research design and its elements, including ontology, epistemology, theoretical perspective, methodology and methods, and scope and delimitations. It also discusses the research stages and the methods employed at each stage.

Chapters 3, **4** and **5** present the literature review, which explores, describes and discusses, in turn, sustainability, design approaches to realize sustainability, and craft as an input into sustainability design.

A diagrammatic representation of the learning from the variables studied through the literature review, and their interconnections, is offered through the conceptual framework in **Chapter 6**.

Chapter 7 begins with the sharing of empirical research and centers on the Kotwalia, a traditional bamboo-craft community from Gujarat, India, who were selected to represent the problem class for this research—non-industrial craft-based MSMEs that work with renewable materials in developing countries. The social, economic, cultural, ecological and technical insights on the Kotwalia offer a window into the compound picture of traditional craft production-to-consumption systems in developing countries.

Chapter 8 offers a construct, the Rhizome Framework, which proposes a possible way forward for craft through design inputs, against the backdrop of generic issues—including unsustainable livelihoods and craft traditions—that are common across non-industrial craft production-to-consumption systems in developing countries, especially in cases where the markets for utilitarian craft products have been replaced by industrialized substitutes.

Chapter 9 presents a methodology, the Rhizome Approach, which was developed through this research process towards a methodology for design–craft collaborations. The Rhizome Approach aims to empower designers to leverage craft production-to-consumption systems in developing countries for sustainability design—including through the directions outlined in the Rhizome Framework.

Chapter 10 discusses the design of an instantiation, in the form of a workshop, which would demonstrate and trial the Rhizome Approach and the Rhizome Framework in the context of the representative client class—the Kotwalia community. It reports on the real-time workshop conducted, and also presents the findings of the empirical research conducted during the workshop—including vis-à-vis the efficacy of Rhizome Framework and the Rhizome Approach, and all of the mechanisms required to actualize these.

Chapter 11 presents the process and findings of the validation phase of the Rhizome Framework and its constituents.

Chapter 12 discusses the second cycle of iteration—culminating in the development of the Holistic Sustainability System—and a branding, labeling and certification system to support its operationalization.

Finally, **Chapter 13** presents conclusions, discussions and recommendations, towards reflectively and coherently tying together pertinent findings and issues covered in the previous chapters and identifying points of departure for further research.

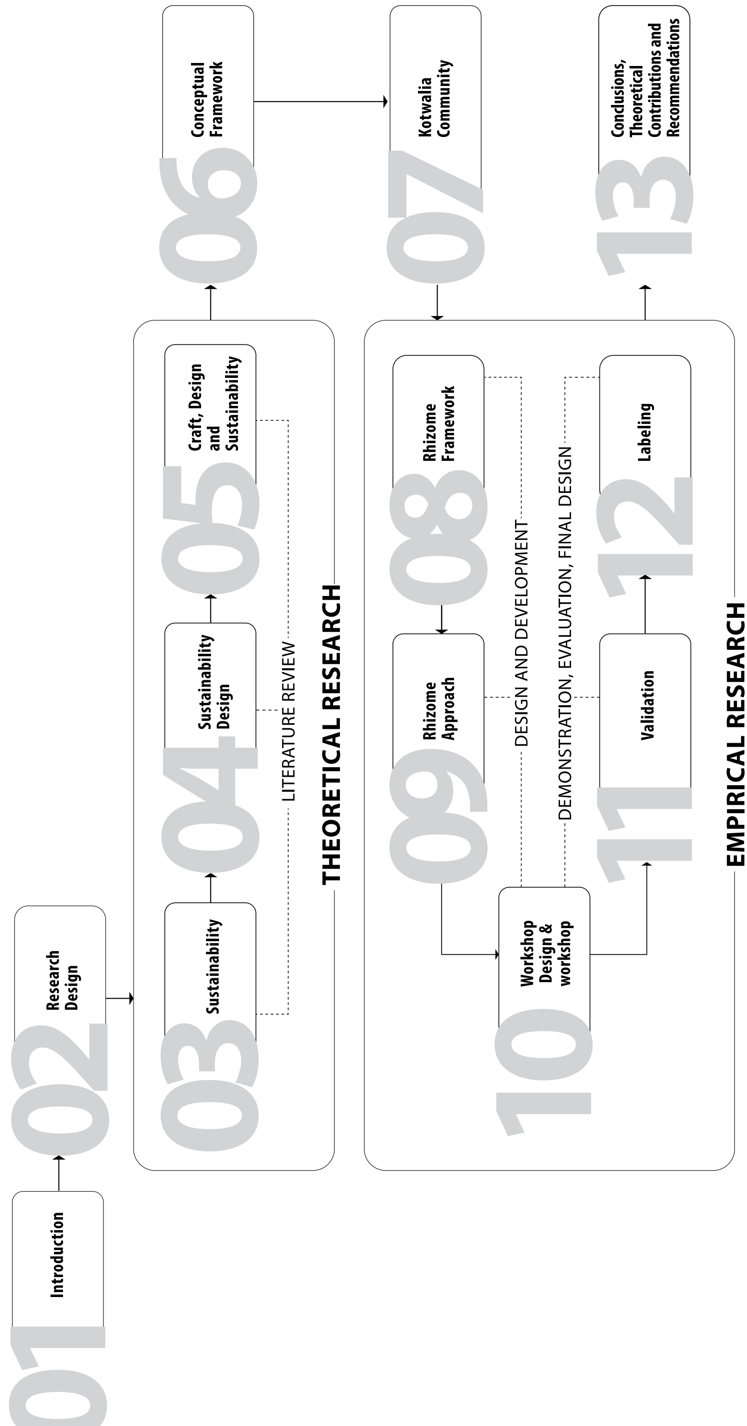


Figure 1.2: Outline of Thesis (Reubens 2016)

02 RESEARCH DESIGN

This chapter discusses the research design and its elements, including ontology, epistemology, theoretical perspective, methodology and methods. Our meta-theoretical perspective of critical realism—and the inherent ontological and resultant epistemological implications—are discussed in 2.1. The selected research methodology, design science research, is discussed in 2.2. This section includes the rationale behind choosing a relatively new methodology, and a discussion on how its generic process stages were adapted for our research. The research stages—i.e., the steps followed to actualize this research, from the identification of a real-world context to the communication of the findings—and the methods employed at each stage, are discussed in 2.3. Finally, in 2.4, we offer the scope and delimitations of this research—including subjectivity and role of the researcher, reliability and validity, and generalizability.

2.1 PHILOSOPHICAL POSITION AND THEORETICAL PERSPECTIVE: CRITICAL REALISM

Scholars recommend that the starting point for the research design should be the nature of the phenomena under study (Landry & Banville, 1992) as outlined by the research questions. However, a researcher's ontology (belief of being and what is)—though irrefutable and personal—implicitly shapes these questions by assuming what there is to be known. This, in turn, shapes the research design elements, delineated by Crotty (1998) as being comprised of interrelated elements—namely, a) epistemology (theory of knowledge or how what is assumed to be knowable can be known) (Blaikie, 2000), b) theoretical perspective (the philosophical and logical stance inherent in the epistemology, which informs the methodology) (Crotty, 1998), c) methodology (how can we go about acquiring knowledge) and methods (what procedure can we use to acquire it) (Hay, 2002). While this research adopts Crotty's (1998) research-design schema, it separates his conceptually inseparable elements of ontology and epistemology, since differing ontological and epistemological stances are characteristic of critical realism—the philosophical and theoretical perspective that this research assumes due to the nature of the research questions and our inherent ontology. Critical realism holds that there is a single reality, which each of us interprets, understands and conceives of differently (Sage, n.d.). It argues that each observable event is caused by several unobservable events; thus, understanding the observable event implicitly calls for a study of the unobservable events. Critical realism, therefore, asks the researcher to distinguish between the event and its cause, and also to be mindful of the possibility that each phenomenon can have alternative and valid accounts stemming from different worldviews, and that all knowledge is partial and incomplete (Sage, n.d.).

Generally, both parts of the researcher's philosophical perspective—ontology and epistemology—organically align with each other and with the theoretical perspective (Sage, n.d.) of the research. In the case of critical realism, the differing ontological and epistemological stances—and the subordination of epistemology to ontology (Fleetwood, 2013)—stem from the argument that, while there is a single reality (ontological realism), that reality can have multiple interpretations (epistemological relativity) (Bhaskar, 2008). Critical realism argues that these interpretations occur because of depth ontology—the belief that reality is stratified into multiple realms: the empirical (observable by individuals or through scientific inquiry), the actual (events and outcomes occurring in the world which are not simultaneously and comprehensively perceived by us), and the real (which comprises the underlying mechanisms that cause events in the realm of the actual) (Fleetwood, 2013). Critical realism argues that while a singular reality exists, we cannot observe it completely, as much of it lies in the realms of the actual and the real. Therefore, our knowledge, which is generally restricted to the realm of the empirical, is fallible and incomplete (Owens, n.d.). Critical realism therefore advocates that scientific research go beyond generating explanatory laws related to observable events (positivism), and exploring different interpretations of events (relativism), to develop a deeper understanding of the causal mechanisms of these events (Bhaskar, 2008). It also advocates the leveraging of this deeper understanding of causal mechanisms towards shaping reality (Isaksen, 2012). Thus, critical realism offers a maximally inclusive meta-theoretical perspective (Bhaskar & Danermark, 2006), based on the holy trinity of ontological realism, epistemic relativism and judgmental rationality (Owens, n.d.).

Critical realism incorporates the best of the classical interpretivist and positivist theoretical perspectives, and is open to both qualitative and quantitative approaches. Positivism inherently centers on a quantitative approach. It seeks to objectively predict reality, generally by observing and measuring the relationship between two variables. Interpretivism inherently centers on a qualitative approach. It seeks to understand reality deeply, generally by recording and understanding variables in a specific context. Critical realism is broader in scope than both of these. It seeks to explore why and how the world functions as it does (Mackenzie & Knipe, 2006), and also to build reality through abductive reasoning or retroduction (Danermark, Ekström, Jakobsen, & Karlsson, 2002)—the purpose of which is to imagine and test deep causal mechanisms (Isaksen, 2012). It, therefore, draws on both the qualitative approach of interpretivism and the quantitative approach of positivism. This can be seen, for example, in our interventionist research, with its dual qualitative and quantitative intentions of: a) understanding the extent to which designers address the dimensions of sustainability in a holistic manner, especially in the context of non-industrial production-to-consumption systems (Research Question 1), b) developing and testing a sustainability-design approach that can improve the capacity of preexisting sustainability-design approaches to address a holistic picture of sustainability within the same context (Research Question 2), and c) identifying and creating mechanisms that can increase and support the new holistic sustainability-design approach that would be created (Research Question 3).

Critical realism has been the implicit and explicit (Høyer & Næss, 2008) perspective for much research in the domain of sustainability—one of the key constituents of this research. The genesis of critical realism as a philosophy was in Bhaskar's doctoral research inquiry into why economic theories developed in the context of the developed world could not be applied to the newly decolonized nations in the developing world without adaptations to their context (Hawke, 2014)—a subject which resonates with our inquiry into the possibility of a holistic sustainability-design approach that could be applied in the context of craft producers in developing countries. Critical realism supports such emancipatory and critical inquiries (Bhaskar, 2009). It also supports the idea of social scientists being critically involved with the objects of their study—including their emancipation (Sayer, 2000)—through retroduction-led transformative practices (Owens, n.d.). This is in line with the innate aim of our research.

Both critical realism and sustainability science argue that the understanding of complex systems calls for pluri-disciplinarities, and accept knowledge from multiple sources as long as it is useful and practical for society (Isaksen, 2012). Critical realism is open to all kinds of methodologies, methods and sources (Pawson & Tilley, 2001). This includes knowledge that is traditionally considered to be non-scientific and context-specific, including the knowledge of people involved in the research area who may not be scientists (Sayer, 2000)—such as tacit craft-based knowledge and craftspeople, both of which are integral to our research. Finally, critical realism supports the synergistic coexistence of constituents of a traditionally disparate process, including a coherent scientific and methodological set-up alongside traditional non-scientific field knowledge, and field-work alongside the analysis of empirical findings (Jeppesen, 2005). All of this is integral to our selected methodology—design science research—as discussed in the following section.

2.2 METHODOLOGY: DESIGN SCIENCE RESEARCH

It was important to choose a research methodology and methods that were in synergy with the selected theoretical perspective—critical realism. Design science research was selected due to its inherent affinity with critical realism. Design science research is a relatively new design-oriented research approach that has received much attention in the area of Information Systems research. There is no widely accepted definition of design science research, but we adopt Juhani and Venable's (2009) definition of it being a research activity that invents or builds new, innovative artifacts that solve problems or achieve improvements—thereby creating a new reality; rather than simply explaining an existing reality, or helping to make sense of it.

The second reason for choosing this methodology over other, more traditional research methodologies was that it had the potential to solve *wicked problems*—which the dynamic interventionist nature of this inquiry centers on, and which would have been difficult through traditional descriptive research approaches (Gleasure, Feller, & O'Flaherty, 2012). Hevner (2007) characterizes such *wicked problems* as having: a) changeable requirements and constraints based upon fuzzy environmental contexts, b) complex interactions among the subcomponents of the problem and its solution, c) inherent flexibility to change design processes as well as design artifacts, d) a critical dependence upon human cognitive abilities such as creativity to produce effective solutions, and, finally e) a critical dependence on human social abilities.

The research questions demanded an iterative and cyclical methodology (Baburoglu & Ravn, 1992; Baskerville & Wood-Harper, 1998; Checkland, 1981; Chisholm & Elden, 1993; Coghlan, 2001), which could have been provided by several design-oriented approaches. However, the significant and dynamic current scholarship on actualizing design science research afforded it a methodological rigor and procedural transparency, which is still nascent in several other design-oriented research approaches.

The third reason for choosing design science research over other change-focused, collaborative research processes aiming to offer a practical solution to the stakeholders, such as action research, was its focus on developing theoretical knowledge whose value would extend beyond the immediate real-context test group—in which the outputs were demonstrated and tested—to a larger research community (Gustavsen, 1993; Levin, 1993; McKay & Marshall, 2001; Susman & Evered, 1978) interested in the same problem class.

CHARACTERISTICS OF DESIGN SCIENCE RESEARCH

The main characteristics of design science research are: a) it focuses on designing interventions in a real-world context (interventionist), b) those interventions are improved iteratively (process orientation), and c) the evaluation of the iterations contribute to theory building (theory orientation) (Plomp, 2009). The merit of the design is therefore measured, at least partly, by its practicality and effectiveness for users in a real-world context (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). These characteristics dovetail with the objectives of our research: to develop practical (intervention) and theoretical (design principles) contributions—based on an iterative design-and-development process—in and for the real world.

The development of theoretical contributions is an important characteristic of design science research. Therefore, the research process needs to capture a theory which implicitly informs or arises from the practical design processes, and transform this into an explicit theory—including design guidelines, checklists and principles—which can be applied to a similar problem class. (Barab & Squire, 2004; Herrington, Herrington, & Olney, 2012; Plomp & Nieveen, 2013; van den Akker, 1999). In general, this theory can include procedural design principles, or characteristics of the design approach, and substantive design principles, or characteristics of the design intervention (van den Akker, 1999). The theoretical knowledge generated through this design science research will be discussed and presented in the last chapter of this thesis.

DESIGN SCIENCE RESEARCH PROCESS

The design science research process resonates with the generic iterative design process, where four basic design stages—research, analysis, synthesis and evaluation—are cyclically repeated until we achieve a satisfying balance between the intended outcome and practical realization (Plomp & Nieveen, 2013). This research follows the sequential design science research process model developed by Peffers, Tuunanen, Gengler, Rossi, Hui, Virtanen, & Bragge (2006), based on common process elements in literature and current thought in disciplines adjacent to information science. The template comprises six activities depicted in Fig. 2.1, and discussed below:

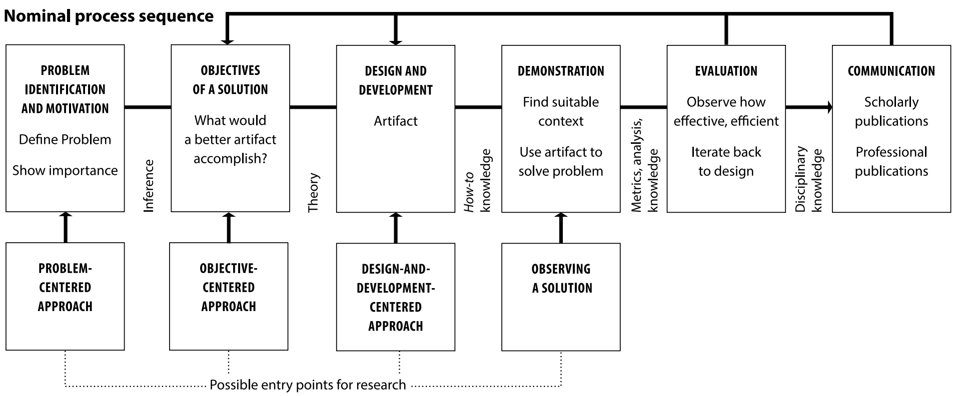


Figure 2.1: Design science research process model (Peffers et al, 2006)

1. Problem identification and research: Define the specific research problem and justify the value of the solution, drawing on knowledge on the state of the problem and the importance of its solution.

2. Objectives of a solution: Rationally infer the quantitative or qualitative objectives of a solution from the problem definition, drawing on knowledge of the state of problems, and current solutions and their efficacy.

3. Design and development: Create an artifactual solution—including constructs, models, methods, or instantiations—drawing on knowledge of theory that can contribute to the solution.

4. Demonstration: Drawing on effective knowledge on how to use the artifact, demonstrate—including through experimentation, simulation, case study, proof, or other appropriate activity—its efficacy in solving the problem.

5. Evaluation: Observe and measure the extent to which the artifact supports the solution to the problem, against the objectives to the solution. If necessary iterate back to Step 3.

6. Communication: Communicate: a) the problem including its importance, b) the artifact including its utility and novelty, the rigor of its design, and its effectiveness to researchers and relevant audiences.

Gleasure et al (2012) suggest carving out one more step—kernel knowledge—from within the first and third steps of the model proposed by Peffers et al (2006), in order to increase procedural transparency. Accordingly, we have identified this step separately in the stages of our research. Additionally, where relevant, the stages of the research were renamed to better align them with the disciplines of industrial design and industrial design engineering, which constitute our disciplinary background and that of the research department where this research was carried out. The stages of this research are depicted in Fig. 2.2 below:

PEFFERS ET AL.'S STAGES		STAGES OF THIS THESIS
Problem identification/motivation Define problem/show importance	→	**1) Problem statement** Formulate the problem statement
Kernel knowledge[45] Understand the existing knowledge and information base	→	**2) Review of background material** Compile and analyze background material
Objectives of a solution What would a better artifact accomplish?	→	**3) Definition of objectives of a solution** Define what a better system would accomplish
Design and development Artifact	→	**4) Design and development** Develop the design
Demonstration Find suitable context Use artifact to solve the problem	→	**5) Demonstration** Find suitable context Test the prototype
Evaluation Observe how efficient, iterate back to design	→	**6) Evaluation** Observe how efficient, iterate back to design
Communication Scholarly publications Professional publications	→	**7) Documentation and dissemination** Document key areas and activities and disseminate them

Figure 2.2: The seven research stages of this thesis (Reubens, 2016)

WHY THIS IS DESIGN SCIENCE RESEARCH AND NOT ACTION RESEARCH

The stages of design science research discussed above were in synergy with the stages of action research—a participatory research methodology where the researcher works in conjunction with the members of a given system to change it in what is jointly regarded as a desirable direction (McMillan, 2004). Järvinen (2007) argues, and this overlap seems to demonstrate, that action research and design science research are similar and interchangeable. However, recent scholarship differentiates between action research and design science research. The difference between the two research methodologies, and the rationale for categorizing this research as design science research, is outlined in Fig. 2.3 below.

SR. NO.	DESIGN SCIENCE RESEARCH	ACTION RESEARCH	WHY THIS RESEARCH IS DESIGN SCIENCE RESEARCH AND NOT ACTION RESEARCH
1	The researcher is the originator of the research and is dominant in the co-operation (Järvinen, 2012).	The practitioner is the originator of the research, and there is a joint collaboration between researcher and client (Iivari & Venable, 2009).	The researcher was the originator of the research and all the mechanisms developed during the research were developed principally by the researcher.
2	The research aims to address a specific class of problems; so potential clients could be assumed to be the set of all individuals or institutions who address the generalized problem class (Venable, 2009).	The research aims to address a specific problem context; therefore, its clients are the members of the system of that specific problem context (McMillan, 2004).	The outputs of this research are intended to be used beyond the real-context test group in which they were demonstrated and tested.
3	The research aims to generate new theories or design principles which support coping with practical problems in real situations (Plomp, 2009).	The generation of theories or design principles which support coping with practical problems in real situations is not a priority.	This research strongly intends to generate theories and principles which support coping with practical problems in real situations.

Figure 2.3: The difference between design science research and action research, and why this research is design science research (Reubens 2016)

2.3 ACTUALIZING THE RESEARCH DESIGN

As discussed above, design science research develops and tests interventions in a real-world context (van den Akker et al, 2006), and improves them (Plomp, 2009) iteratively. It also generates theory that is applicable beyond the intervention scenario, to a larger set of individuals and institutions in the generalized problem class (Venable, 2009). Accordingly, this research sought to select, frame and interpret a real-world problem in context to which the proposed artifact would be developed, tested and improved (Drechsler, 2015). This subset needed to be representative of the larger audience that this design science research aims to address: craft-based MSMEs in developing countries working with renewable materials, with which designers were also working.

We selected the Kotwalia tribe—a bamboo-working community in the Indian state of Gujarat—as the craft group in whose context the first empirical phase of this design science research would take place, for the reasons listed below:

• The Kotwalia work with bamboo—a highly renewable and versatile material which has been receiving tremendous interest from designers working towards sustainability globally.
• We have a strong background and expertise in bamboo, due to our past professional profile as a full-time international consultant with INBAR, and our current work with tribal bamboo-working communities in India, including the Kotwalia.
• The Kotwalia community is located in geographical proximity to Ahmedabad, the location of several premier design institutions—including the National Institute of Design (NID) and the Centre for Environment Planning and Technology (CEPT) University—with which we are academically linked.
• A good representation of traditional craft groups whose sustainability is jeopardized due to globalization, the Kotwalia community is a primitive tribal group, whose traditional market share of bamboo baskets has been shrinking, forcing them to migrate as wage labor.
• Unlike several other craft communities that remain largely undocumented, the socio-economic status and craft of the Kotwalia community have been documented; by us, the NGOs we work with—such as the Eklavya Foundation and the Tapini Bamboo Development Centre—and design students who have interned with us.

The second phase of the empirical research was conducted in Vietnam, in order to check the generalizability of the findings in another developing country, and with materials other than bamboo, in the genre of handicrafts. Vietnam was selected due to our professional linkage with TU Delft's Sustainable Product Innovation (SPIN) project—supported by the European Commission's SWITCH Asia programme—and with UNIDO's Joint Programme, which aims to increase income and employment opportunities for growers/collectors of raw materials, and grassroots producers of handicrafts, clothing, paper, small furniture and home-ware. The operational stages of the research, and the corresponding methods and outputs at each stage (Fig. 2.4) are discussed below:

STAGES OF THIS THESIS	METHODS	OUTPUT
1. Problem statement	• Definition of problem context • Definition of research objective • Definition of research questions	• Problem context • Research objective • Research questions
2. Review of background material	• Accumulation of data and facts • Validation of the existing situation with the Kotwalia community through a scoping study for the National Bank for Agriculture and Rural Development (NABARD)	• Literature review • NABARD scoping study • Findings from documents by three students working with the community • Conceptual framework
	• Study of documentation by three students working with the community to understand the design–craft interaction mode • Development of conceptual framework	
3. Definition of objectives of a solution	• Development of a checklist which would encompass the objectives	• The Sustainability Checklist

	STAGES OF THIS THESIS	METHODS	OUTPUT
ITERATION CYCLE 1	4. Design and development	• Development of a construct, methodology and instantiation based on Stages 1, 2 and 3	• The Rhizome Framework • The Rhizome Approach • Workshop design
ITERATION CYCLE 1	5. Demonstration	• Demonstration of construct and methodology through real-time instantiation	• Bamboo space-making craft workshop
ITERATION CYCLE 1	6. Evaluation	• Monitoring and documentation of workshop through notes, photographs and video • Administering of three questionnaires to evaluate the efficacy of the Rhizome Approach and its constituents • Evaluation of products developed during workshop against the Sustainability Checklist	• Monograph on bamboo space-making workshop • Findings from questionnaires on the efficacy of the Rhizome Approach and its constituents • Products developed during workshop evaluated against the Sustainability Checklist
VALIDATION + ITERATION CYCLE 2	7. Validation	• Collecting feedback on the Rhizome Approach through two questionnaires administered before and after a presentation to a group of 21 SPIN ToT trainers in Vietnam • Collecting feedback on the Rhizome Approach and possible complementary, supplementary or alternative steps to make it more effective by administering a questionnaire by e-mail to 15 designers located across the world	• Findings of questionnaires administered before and after a presentation to a group of 21 SPIN ToT trainers in Vietnam • Findings of questionnaires administered to 15 designers located across the world
VALIDATION + ITERATION CYCLE 2	8. Second iteration of design	• Development of labeling scheme • Development of holistic assessment system • Refinement of the Sustainability Checklist • Development of graphic to visually represent rating • Development of manual to operationalize the Holistic Sustainability Checklist • Development of software with accompanying manual to operationalize Holistic Sustainability Checklist	• Labeling scheme • Holistic Sustainability Assessment System • Holistic Sustainability Checklist • Holistic Sustainability Label • Manual for UNIDO • Software and software manual for UNIDO
VALIDATION + ITERATION CYCLE 2	9. Evaluation of final design	• Evaluation of Holistic Sustainability Checklist through questionnaires administered to three focus groups in Vietnam • Evaluation of the label through questionnaire administered to random walk-ins at LifeStyle Vietnam, the handicraft fair	• Findings from questionnaires administered to three focus groups for the evaluation of the Holistic Sustainability Checklist • Findings from the questionnaire administered to random walk-ins at LifeStyle Vietnam for the evaluation of the label

STAGES OF THIS THESIS	METHODS	OUTPUT
10. Documentation and dissemination (D&D)	• Converting implicit learning arising out of the design science research process into explicit theory • Dissemination of the explicit theory and documentations generated	**Academic D&D** • One scoping study • Two journal articles • One book • One monograph • Nine conference papers • One manual • One chapter in an edited book • Two courses taught at CEPT University on the Rhizome Approach **Practical D&D** • One brand of bamboo products, called Bamboo Canopy, developed for and produced by the Kotwalia community • Mainstreaming of bamboo and sustainability through the work of Rhizome, our sustainability-design firm • Several students' design projects and internships at Rhizome in the area of sustainability design with renewable materials • One project to design three collections of sustainable bamboo furniture for the Interio brand from Godrej & Boyce Mfg. Co. Ltd

Figure 2.4: Operational stages of our research

STAGE 1: PROBLEM STATEMENT

The research began with the formulation of the problem statement, through the problem context (1.2), research objective (1.3) and research questions (1.3). The problem context includes the importance of renewable materials, and explores design's role in sustaining craft-based production-to-consumption systems, which are often based on renewable materials. We also discuss the need for design approaches which address sustainability in a holistic manner in the case of such production-to-consumption systems—including and especially by addressing developing-country problems such as poverty and unemployment.

This sets the stage for the research objective—to improve sustainability-design approaches (Research Question 2), and identify and put in place the mechanisms to increase its application, thereby impacting practice (Research Question 3), in the domain of MSMEs working with renewable materials in developing countries. For this, we will first seek to understand the extent to which current design approaches address sustainability in a holistic manner (Research Question 1), as discussed below.

STAGE 2: REVIEW OF BACKGROUND MATERIAL

The first step in addressing the problem stated in Stage 1, was compiling, analyzing, and—where relevant—validating the background material. Literature pertaining to Research Question 1—which focuses on the extent to which current design approaches aimed at achieving sustainability do so holistically—is presented through the literature review in Chapters 3, 4 and 5. A conceptual framework that depicts the understandings of the scenario, including from the literature review, is offered in Chapter 5.

We compiled and studied the background material on the Kotwalia community, and then validated it through a scoping study conducted for the National Bank for Rural Development (NABARD) (Reubens, 2010c). This study is available as an independent document, and excerpts from it are offered in Chapter 6, which seeks to provide an overview of the Kotwalia community's situation.

The manner in which design students interface with the Kotwalia community was studied through the documents from three internships and diploma projects, wherein NID students worked with the Kotwalia community under our guidance. The aim of this exercise was to better understand the nuances of design–craft interactions through the designers' accounts and experiences recorded in the diploma documents. Relevant excerpts from these documents—including the documentation of the Kotwalia community's product range through a product library exercise—are presented in Chapter 7.

STAGE 3: DEFNITION OF OBJECTIVES OF A SOLUTION

Based on the problem statement and review of relevant background material discussed earlier, we explored the objectives of a solution with the underlying inquiry—what would a better artifact accomplish? This stage resonates with the steps of formulating a design vision and specifications that are central to industrial design methodology, and centers on listing requirements: objectives that design alternatives should meet, and goals, or images of intended situations (Eekels & Roozenburg, 1991).

In order to clarify what a better artifact would accomplish, we developed a design brief, which was further detailed into the Sustainability Checklist that illustrates the production-to-consumption system for a generic product, and the sustainability-design parameters relevant at each stage. The checklist makes the innovator aware of the potential and desired criteria that can make a product more holistically sustainable. The checklist was refined into the Holistic Sustainability Checklist during the second phase of iterations, details of which can be found in Chapter 9.

STAGE 4: DESIGN AND DEVELOPMENT

The design-and-development stage centers on creating artifactual solutions—including constructs, methods and instantiations (Hevner, March, & Park, 2004)—that draw on the combination of the problem statement, and a review of the relevant background material and the objectives of the solution. First, we developed a construct—the Rhizome Framework—which outlines three viable directions that traditional craft might take while using design inputs. The Rhizome Framework is discussed in Chapter 8. Next, we developed a method; the Rhizome Approach, which supports designers in actualizing the objectives of the solution, is discussed in Chapter 9. Finally, an instantiation was developed—in the form of a workshop—which trialed the Rhizome Framework and the Rhizome Approach. A detailed discussion on the design of the workshop and its actualization is offered in Chapter 10.

STAGE 5: DEMONSTRATION

The instantiation developed in the previous stage was trialed through a collaborative multi-institution Bamboo Space-Making Craft workshop, which was held at the Design Innovation and Craft Resource Centre (DICRC) at CEPT University, Ahmedabad, in India. This workshop was the first in a series of space-making craft workshops scheduled with different craft materials at the DICRC. The participating designers included professionals, students from the Indian Institute of Crafts and Design (IICD), Jaipur, and graduates, postgraduates and students from the Faculty of Design, CEPT University, Ahmedabad. The workshop facilitators included faculty and resource people from the DICRC, IICD, Eklavya Foundation, Tapini Bamboo Development Centre and the researcher.

A description of the workshop's design and activities is offered in Chapter 10.

STAGE 6: EVALUATION

In design science research, the success of the intervention depends on its efficacy in a real-world situation. In this case, that was the Bamboo Space-Making Craft workshop discussed in the previous step. The workshop was monitored and documented carefully, both audio-visually, and through our own notes. In addition, four questionnaires were administered to the design participants over the course of the workshop. These questionnaires were designed such that the first served as a baseline of the participants' understanding of core concepts—including sustainability and design for sustainability—and the last repeated some of the key questions so as to map the changes in their understanding of these concepts.

In order to maintain reliability and validity through data and methodological triangulation, each participant was asked to write an account of their experience. This enabled member checking, to correct errors of fact and interpretation. Each participant's design was reviewed by three different experts to enable expert review and data triangulation.

A detailed description of the evaluation stage is presented in Chapter 10.

STAGE 7: VALIDATION

In design science research, the theory generated should be applicable to a larger set of individuals and institutions in the generalized problem class (Venable, 2009). To test that this was the case, and thereby validate the theory generated, the Rhizome Approach and Sustainability Checklist in particular was reviewed by administering two questionnaires to 21 trainers from TU Delft's SPIN project. The aim was to check the potential transferability of the findings to another developing country and with materials other than bamboo in the genre of handicrafts.

In addition to this, a questionnaire was administered by e-mail to 15 designers located across Africa, Australia, Europe, Latin America, Turkey and Southeast Asia. The questionnaire explored the opinion of the respondents on the Rhizome Approach and whether they felt there could be complementary, supplementary or alternative steps to the Rhizome Approach, to make it more effective.

The findings of these two face-validity exercises are offered in Chapter 11.

STAGE 8: SECOND ITERATION OF DESIGN

Based on inputs from the focus group, and to answer Research Question 3, we further refined and developed the Sustainability Checklist into the Holistic Sustainability Checklist for UNIDO, and designed a Holistic Sustainability Assessment System and a Holistic Sustainability Label to complete the design cycle.

The final designs and their development are discussed in Chapter 12.

STAGE 9: EVALUATION OF FINAL DESIGN

We evaluated the final designs through focus groups and through questionnaires administered at LifeStyle Vietnam, the handicrafts fair in Vietnam. The findings from the evaluation of the final designs are discussed in Chapter 12.

STAGE 10: DOCUMENTATION AND DISSEMINATION

Theoretical contributions to knowledge form an important aspect of design science research. At every stage of our research, we documented project-relevant aspects and generated dissemination material. The dissemination material is discussed in each relevant chapter and also in the final chapter, which focuses on the theoretical contributions of this thesis.

The operational stages of this research are illustrated in Fig. 2.5 to provide a blueprint for the research-process stages and chapterization of this thesis.

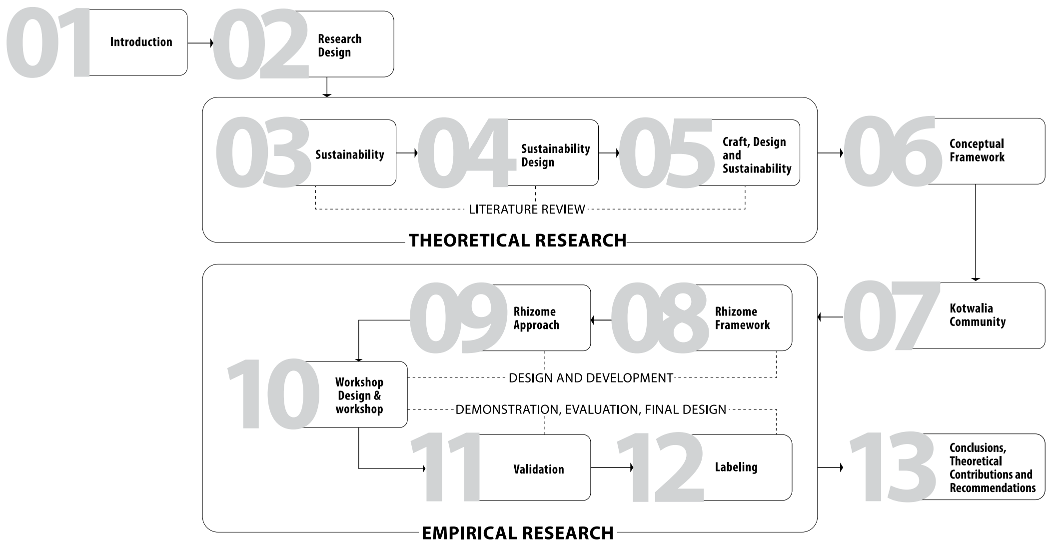


Figure 2.5: Outline of thesis (Reubens 2016)

2.4 RESEARCH SCOPE AND DELIMITATIONS

As discussed earlier, the empirical part of this design science research was conducted in two scenarios; we were involved in both phases in a professional capacity. In the first instance, we co-facilitated the Bamboo Space-Making Craft Workshop in India—where data was collected through questionnaires and written accounts by the participants. In the second instance, we served as a consultant to TU Delft's SPIN project and UNIDO's Joint Programme in Vietnam. We collected data from focus-group discussions, and by administering questionnaires to the same groups to collect quantitative data. In addition, we conducted an overall validation by e-mail in different scenarios. The implications of the empirical research decisions are discussed in the following paragraphs.

SUBJECTIVITY AND THE ROLE OF THE RESEARCHER

Design science research is intrinsically linked to human agency. This makes it inherently subjective, because: a) it involves the construction of socio-technical artifacts which are inseparable from society, and therefore from human subjectivity, b) it involves the subjectivity of the artifact's users arising from their perceptions of how and to what extent the artifact can solve the problem, c) the researcher is predominantly a designer whose creativity and subjectivity affects every stage of the research, and d) the subjectivity of the design science research process remains embodied in the final artifact, even after it is published and used in other contexts by individuals other than the researcher (Drechsler, 2015).

Dreschsler (2015) argues that the issue of objectivity in design science research—as compared to empirical research—is compounded by the researcher's dual authorship role over different stages. During the design stage, the researcher authors the artifact; and then, during the evaluation stage, authors the empirical research account. During the design phase, the researcher actively and intentionally creates the artifact that aims to shape reality through the process of design science research. Subjectivity comes into play as different designers would approach the same problem context differently, and arrive at different artifactual solutions. During the evaluation phase, the researcher's role switches to passive observation of the effects of the artifact; however—as with most empirical research—subjectivity is innate in the researcher's rendition of the research account.

We agree with Stahl (2009) in that the inherent subjectivity of design science research does not indicate that researchers should avoid shaping research, or that they should be timid or conservative in designing or decision-making. Rather, design science research calls for researchers to be mindful of the ethico-political dimension relating to both the creation and evaluation of artifacts (Stahl, 2009). Accordingly, we have been mindful of the advice of scholars that researchers self-reflect on their role, decisions and limitations for which they are responsible and the potential impact of their research, and accordingly take deliberate, conscious and responsible decisions (Drechsler, 2015). This is especially relevant in the case of design science research projects that have the potential to deeply impact society—such as our research, which can potentially impact the sustainability of indigent craftspeople in the developing world.

Researchers are advised to consciously seek to induce objectivity, by seeking other voices and solutions (Drechsler, 2015) in their research. In cognizance with the rationale to consciously cultivate objectivity in our research, each of the artifacts designed during the design-and-development phase was reviewed by experts and the designs changed accordingly. During the demonstration stage, faculty and resource persons from CEPT University's DICRC, Eklavya Foundation, TBDC and IICD were also involved in workshop facilitation alongside ourselves—with a view to increasing objectivity and diluting our role in facilitation, towards achieving unbiased data. In addition, an overall validation was conducted by administering a questionnaire by e-mail to designers not involved with us or our research, and located across the world in different scenarios.

RELIABILITY AND VALIDATION

Given the multiple roles of the researcher (Richy & Klein, 2005) in design science research, strategies should be put in place to ensure unbiased data. Our research included triangulation and expert review, as efforts towards objectivity and unbiased data collection. Design-oriented research projects typically utilize multiple research methods within and between each phase of the project (Diehl, 2010). In line with this, different approaches—including data, investigator and methodological triangulation, member checking to correct errors of fact and interpretation, and expert review—were integrated into the research design with the aim of achieving reliability and validity. Each of the artifacts designed—the Rhizome Framework, the Rhizome Approach, the workshop—was reviewed by different subject experts.

We used triangulation to map the complexity of the problem by studying it from more than a single standpoint (Cohen & Manion, 2000) and also to cross-check the validity of the results (Bryman, 2001). We used methodological triangulation, specifically, between-method triangulation (Denzin, 1970)—which uses contrasting research methods to collect data—with regards to the main intervention, i.e., the workshop. We gathered data through questionnaires, first-person accounts, and notes of the workshop coordinator—in addition to our own notes. This data was member-checked by the participants (Denzin, 1978).

We administered the questionnaires over the course of the workshop in India, during the validation phase during the second iteration in Vietnam, and during the final validation across the world. This enabled data triangulation—gathering data at different times and social situations as well as from different groups of people (Denzin, 1978). Data triangulation and expert review were also inherent in the assessment of participants' products by three different subject experts.

TRANSFERABILITY

A key characteristic of design science research—and an important factor in our selection of design science research over action research—is generating novel theoretical contributions which can be applied to the set of all individuals or institutions that tackle the generalized problem class (Venable, 2009). However, given that every problem in unique and different, we were mindful of the fact that the artifacts generated should not be viewed as grand narratives, which would provide turnkey solutions to the problem class (Drechsler, 2015). Instead, we aimed for generalizability to the extent that the artifacts would function as triggers for solutions (Drechsler, 2015) by being adaptable to different contexts in the same problem class. We tested this generalizability by administering a questionnaire to designers located in different regions across the world on the relevance of the research outputs to their practice and region. This is also in line with our critical realist theoretical perspective, which advocates tempering fallible and incomplete knowledge with judgmental rationality (Owens, n.d.) to adapt *truths* to the different interpretations of a single reality.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03 SUSTAINABILITY AND DEVELOPMENT

The research design presented in the previous chapter proposed that we initiate the inquiry into Research Question 1—the extent to which designers address sustainability in a holistic manner, while working with non-industrial, renewable materials and craft-based MSMEs in developing countries—with a literature review. The literature review is an important means of avoiding the repetition and duplication of existing research in subsequent research steps, i.e., the proposed design solutions. This chapter presents the first of a three-part literature review that focuses consecutively on sustainability and development, sustainability design, and craft–design collaboration towards sustainability. Each topic encompasses subtopics (as depicted in Fig. 3.1) and puts in place reference points for key concepts in this research. Thus, each consecutive topic builds upon learning from previous topics, taking us closer and closer to an answer to Research Question 1.

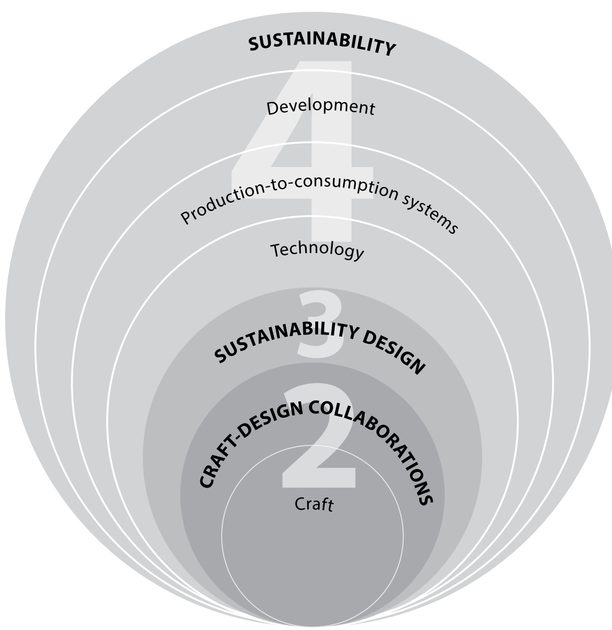

Figure 3.1: Representation of the interlinked themes of this research, with the three literature-review topics and their corresponding chapter numbers (Reubens 2016)

We begin the literature review in this chapter focusing on preexisting literature that dwells on the broad theme of sustainability and development. One salient aim of this literature review is to explore and articulate the concept of holistic sustainability—integral to Research Questions 1 and 2—and to identify/formulate a definition for it, to serve as a reference point for this thesis.

In 3.1, the beginning and acceleration of unsustainability are mapped against the macro picture of world history. The aim of this exercise is to situate the concept of sustainability as an emergent property of evolving human production-to-consumption systems and development processes, which are interlinked globally. We discuss, in 3.2, how the recognition of the links between sustainability and development in the post-industrial era crystallized into the concept of sustainable development. We also discuss the persistent calls—including from different global forums and platforms—for the mainstream sustainable-development paradigm to move beyond economic ascendancy, and embrace social, cultural and ecological concerns. In 3.3, we review the expanding scholarship on sustainability and its dimensions. We also look at the sentential representations of sustainability and sustainable development (3.4), to better understand the priority and relationship between the dimensions. Finally, we offer a conclusion in 3.5, consolidating the literature reviewed in this chapter, and its implications vis-à-vis Research Question 1.

3.1 HOW DEVELOPMENT SHAPES SUSTAINABILITY

Our world is facing urgent crises ranging from traditional development issues such as poverty, hunger, health and income security, to new challenges such as climate change and globalization (Munasinghe, 2010). These tremendous forms of unsustainability make it imperative to investigate and address the causes of the existing acute and pressing unsustainability that threatens human survival, and the survival of the systems—including ecological, social, economic and cultural ones—that constitute our world.

PRODUCTION-TO-CONSUMPTION SYSTEMS AND UNSUSTAINABILITY IN THE PRE-INDUSTRIAL WORLD

Concerns about sustaining our world are not a recent phenomenon; visionaries through the ages have deliberated on the impact of human activities on Earth's ecosystems (Pezzey & Toman, 2002). Scientists claim that we are now in the Anthropocene—an epoch in which human activity shapes the planet's geological future, alongside natural occurrences such as ice ages and volcanic eruptions (Berkeley, 2011). The beginning of the Anthropocene, and unsustainability in general, is commonly traced back to the industrial revolution and its production-to-consumption systems—which facilitated unprecedented development and, thereby, tremendous ecological devastation, forcing public attention on the need to recognize and cultivate sustainability globally (Edwards, 2005). However, the industrial revolution was not an isolated event; the conditions for its full blown take-off (Rostow, 1960) were created over the course of human development and the production-to-consumption systems that underpinned this process.

Around 12,000 years ago, humans began transitioning from a forest-based subsistence to agriculture and animal husbandry (Lloyd, 2008). The resultant food security led to the emergence of technologies and professions that were not based on producing food—such as in the case of artisans, who crafted things of daily use for recently settled tribes using natural materials (Lloyd, 2008; Overy, 2007). The trade of agricultural and non-agricultural surplus in turn led to the first pre-industrial production-to-consumption systems and value-chain actors including traders, account keepers, and transporters (Lloyd, 2008; Overy, 2007). Thus, the production of surplus by pre-industrial societies financed both industrial development and the development of suitable trading and government institutions (Lloyd, 2008; Overy, 2007).

As civilizations flourished, global legacies of nature-worship (Lloyd, 2008; Overy, 2007) were remodeled. In South Asia, tribal nature-worship crystallized into religions like Hinduism, Jainism and Buddhism (Lloyd, 2008; Overy, 2007). In other parts of Eurasia, religions like Judaism, Christianity and Islam (Lloyd, 2008)—coupled with the advent of Western scientific thought—shifted people's worldview from the pagan veneration of nature, to seeing nature as a hostile, alien and harsh (Ehrenfeld, 2008) resource to be harnessed (Lloyd, 2008) under the shield of technology. Traders and raiders carried this new philosophy to distant communities, heralding the beginnings of globalization and a single worldview (Lloyd, 2008). The changes in worldview were actualized in the natural landscape. In 500 AD, more than 80% of the European landscape was forested, but by 1300 AD, less than 50% remained that way (Lloyd, 2008).

The growing needs of an escalating population in rapidly developing Europe demanded a maritime search for resource-rich colonies (Lloyd, 2008). The expansion of Europe caused large-scale global redistribution: flora and fauna moved across continents, there was mass human migration, mineral wealth was tapped, and regional economic specialization and sea transport facilitated trade realignment (Lloyd, 2008; Overy, 2007). Using the colonies as production bases for agricultural and non-agricultural export produce replaced their extant robust natural diversity (Lloyd, 2008; Overy, 2007) with a fragile monoculture. The influx of Europeans to the colonies as adventurers, entrepreneurs or refugees (Lloyd, 2008; Overy, 2007), saw several species of fauna—especially those which were hunted for their skin and fur—becoming endangered and, eventually, extinct. The incursions brought new diseases, violence and land appropriation, which caused several indigenous communities to become endangered and extinct as well (Lloyd, 2008; Overy, 2007).

PRODUCTION-TO-CONSUMPTION SYSTEMS AND UNSUSTAINABILITY IN THE INDUSTRIAL WORLD

The growing dissent over the inequality between European colonizers and their colonies caused numerous uprisings; resulting in the independence of several colonies, including the United States (Lloyd, 2008; Overy, 2007). Simultaneously, the new notions of liberty, equality and individual rights reshuffled Europe's social and labor systems (Lloyd, 2008; Overy, 2007). The energy crisis—Britain had already moved from using wood to coal—and the simultaneous non-availability of slave labor because of Britain's slave-trading ban of 1807 (Lloyd, 2008; Overy, 2007) begged for an alternative, which took the form of the industrial revolution.

The demands of European industrialization created a renewed fervor to colonize, in order to gain control of land, labor, commodities and markets (Lloyd, 2008; Overy, 2007), around 1870. According to Overy (2007), the economic gains of 19th-century Europe were made at the expense of the native populations of its colonies in Asia, Africa, Australia and America. By the time these colonies gained political independence, their land had been exhausted, their raw materials had been depleted, and they were locked in rural and national debt due to trade agreements (Lloyd, 2008; Overy, 2007). The eventual emancipation of Asia and Africa, and the rise of Japan, saw the European Age give way to the age of global civilization in the early 1900s; thousand-year-old agricultural pre-industrial systems were replaced with urban, industrialized and technocratic systems (Overy, 2007). This caused rapid increases in population and economic growth with a quality of life that did not match (Lloyd, 2008) laying the ground for the pressing unsustainability we face today.

THE LINK BETWEEN PRODUCTION-TO-CONSUMPTION SYSTEMS, DEVELOPMENT AND UNSUSTAINABILITY

As discussed above, the current state of unsustainability cannot be attributed to the industrial revolution, or to any other isolated phenomenon (Rostow, 1960). It is the cumulative result of the development process; development resulted in secure production-to-consumption systems, which resulted in population growth, which called for more resources, which in turn prompted more development (Nkechinyere, 2010). Thus, through the ages, development was both the cause and effect of incremental development, and simultaneous incremental unsustainability.

Each production-to-consumption system that emerged and evolved over the development process had significant direct and indirect impact on the world and its systems. The production input influenced raw material utilization and flows, i.e., ecological sustainability; the production process facilitated by technology affected the dynamics of labor and employment, i.e., social sustainability; and systems of exchange affected trade and development, i.e., economic sustainability. All of these were orchestrated by changing human worldviews (Ehrenfeld, 2008), thus affecting cultural sustainability. The tiniest change in each production-to-consumption system affected each of the world's complex, interlinked, and dynamic systems in differing degrees—ranging from the profound to the insignificant. Sustainability—or the lack of thereof, i.e., unsustainability—is, therefore, the emergent property of the collective production-to-consumption systems that underpin development (Ehrenfeld, 2008).

Over the ages, the economic benefits of development have been optimized by globalization—including through the rationalization of production-to-consumption systems on a global scale, resulting in economies of scale and more efficient optimal outputs (Ehrenfeld, 2008). These benefits are not equitable within or across nations; invariably, the ratio is skewed in favor of the affluent (Munasinghe, 2010). Ecological costs are also inequitably distributed across and within nations: developing countries now host global production centers, and also bear their ecological costs—such as pollution, and biodiversity and resource depletion (Munasinghe, 2010). The social costs caused by these relocated globalized production-to-consumption systems—including unemployment, inequity, breakdown of socio-economic community systems and income disparity (Stiglitz, 2002)—have also shifted to developing countries. Globalization and media bombardment have caused developing countries to metamorphose too quickly for them to preserve and, sometimes, to even record their cultural capital, leading to cultural unsustainability.

Developed countries—which incurred similar costs during the industrial revolution—caution against the path of rapid industrialization. This is because the burgeoning populations and nascent levels of governance in the developing countries will likely magnify the costs associated with the development process (Munasinghe, 2010). However, developing countries argue that the developed world has already used up a large part of Earth's ecological resources to fuel its own development and industrialization; that the environmental policies these countries now lobby for would affect the potential of economic growth for developing countries (Munasinghe, 2009).

That the pursuit for development will continue is unquestionable. Equally obvious is that sustainability depends on this phase of development being different from past paradigms, where production-to-consumption systems existed at the cost of economies, societies, cultures and the ecology. The way forward seems to be through development that is based on a holistic vision of sustainability, which includes both developed-country concerns such as resource depletion, unsustainable growth and pollution, and developing-country priorities such as poverty alleviation, equity and development (Munasinghe, 2010).

3.2 SUSTAINABLE DEVELOPMENT

Sustainability began to crystallize as an ecological concept during the industrial revolution, following public dissent on the effect of unprecedented development onthe environment (Hawken, Lovins, & Lovins, 1999). The links between ecological unsustainability and unprecedented industrialization-based economic growth became increasingly obvious amid growing awareness on sustainability all through the 1970s (Adams, 2006). The United Nations Conference on the Human Environment in 1972—also known as the Stockholm Conference—was a turning point in acknowledging the connection between the biosphere and human development, through the idea of ecologically sustainable development (Mann, 2011).

In 1983, the United Nations convened the World Commission on Environment and Development—also known as the Brundtland Commission—to address the "accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development" (Brundtland, 1987, p. 43). The Commission's 1987 report—Our Common Future—presented the idea of sustainable development to the world as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 43). The report discussed how the world's economic systems could contribute to solving ecology-related issues, alongside development-related issues of equitable growth—including poverty and under-development—which had emerged in the 1960s (Munasinghe, 2010). This created a paradigm shift in understanding sustainability as a primarily ecological concept, as it married post-industrial ecological concerns with development—which has social and economic connotations (Barash & Webel, 2002).

The view that sustainable development needed to address social, ecological and economic aspects was revisited at the United Nations Earth Summit in 1992, against the backdrop of discussions on integrated economics and equity. The Rio Declaration clearly stated that the environment and social and economic development can no longer be viewed separately as isolated fields (United Nations Sustainable Development, 1992). The Millennium Development Goals produced at the United Nations Millennium Summit in 2000 included poverty, education, gender, child mortality, maternal health, combating diseases, environmental sustainability and global partnerships (Mabogunje, 2002) for sustainable development. These reiterated the need for sustainable development to address diverse aspects, and were widely accepted by world leaders as indicators to measure progress. The Millennium Development Goals were reiterated in the top priorities at the World Summit on Sustainable Development in Johannesburg in 2002, and resonated with the WEHAB thematic areas of water, energy, health, agriculture and biodiversity (Munasinghe, 2010).

In 2012, the United Nations Conference on Sustainable Development—informally known as Rio+20—proposed a set of Sustainable Development Goals, which underlined the importance of precedents including Agenda 21, the Johannesburg Plan of Implementation and the Millennium Development Goals.

The need for sustainable development to address social, ecological and economic dimensions and their interlinkages in a balanced manner (Le Blanc, Liu, O'Connor, & Zubcevic, 2012) has been reiterated through different global forums and platforms. However—despite the general consensus that sustainable development needs to be more holistic and to include diverse representations and multiple issues—these forums and platforms have failed to come up with a clear way forward. This is because nations have consistently prioritized the economic aspect, and there has been no political will to take the brave leap towards the uncharted path to sustainability. While most countries are on the same page in their pursuit of economic ascendancy, different visions and priorities—in general, the developed world prioritizes the ecological dimension, while the developed world prioritizes the social dimension (Fig. 3.2)—have brought global sustainability dialogue and action to an impasse.

The immediate crises—financial recession on the one hand and environmental catastrophe on the other (Narain, 2012)—need to be urgently addressed. Yet, although international discourse on sustainability has grown steadily, the goals outlined towards achieving sustainable development have decreased, and the few goals decided upon have not been successfully attained (Munasinghe, 2010). While sustainable development continues to be a powerful and, some argue, useful paradigm (Thorpe, 2007), there is steady discussion emerging, on the need to step back from the current anthropocentric and economic focus (Sutton, 2004); to revisit The Future We Want (United Nations Conference on Sustainable Development, 2012)—the larger non-negotiable outcome desired: "the possibility that humans and other life will flourish on the Earth forever"(Ehrenfeld, 2008, p. 49), by consciously maintaining the balance between different tenets of sustainability, including ecological, social, cultural and economic conditions.

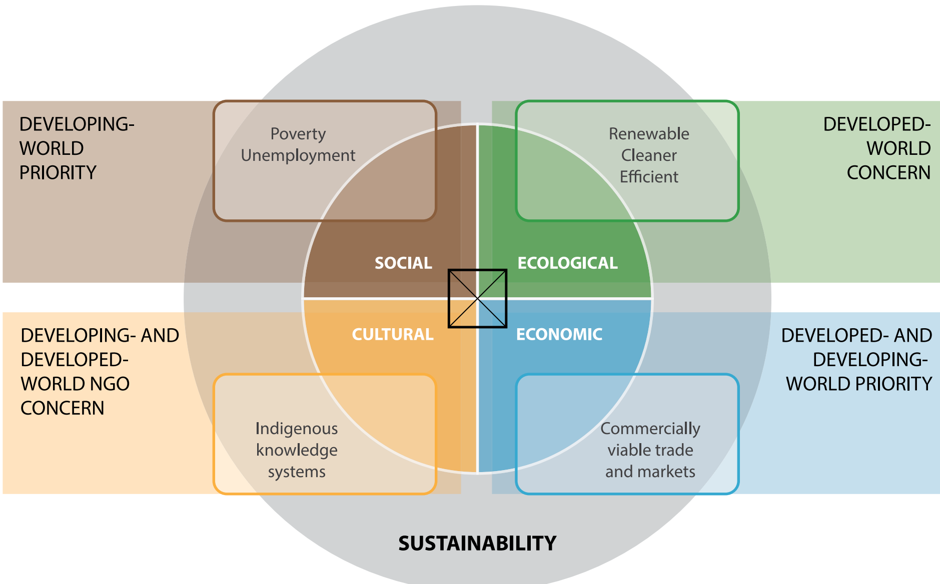

Figure 3.2: Developed- and developing-world sustainability priorities and concerns (Reubens 2015)

3.3 THE DIMENSIONS OF SUSTAINABILITY

This section discusses the main dimensions (also known as domains, systems, areas, disciplines and pillars) (Mann, 2011) of sustainability. A large part of sustainability and sustainable development praxis centers on three main dimensions: ecological, social and economic (also known as planet, people and profit) (Elkington, 1998). The social dimension traditionally subsumes a cultural dimension of sustainability (Duxbury & Gillette, 2007). However, recent scholarship has separated the two (Munasinghe, 2010) in order to present a clearer picture of the complex nature of sustainability (Mann, 2011). Each of the four identified dimensions of sustainability is discussed separately below:

ECOLOGICAL SUSTAINABILITY

Ecological sustainability focuses on maintaining the vitality and health of natural capital (Costanza, 2000), including the atmosphere, hydrosphere, lithosphere, and biosphere (Costanza, 1991). Everything we use comes from one of these spheres, and, when disposed of, returns to one of these spheres (Thorpe, 2007).

Maintaining resilience—the ability to regain equilibrium after a disruptive shock (Pimm, 1984)—is more difficult for ecological systems than for anthropocentric systems, such as social and cultural systems (Munasinghe, 2010). This is because human-centric systems are better able to plan their own adaptation (Munasinghe, 2010). In contrast, natural systems need continuity of ecological processes on micro- and macro-spatial scales in order to be resilient (Peterson et al, 1998). Therefore, maintaining safe thresholds and not exceeding the carrying capacity of ecological systems (Ciriacy-Wantrup, 1952) are imperative to avoid catastrophic ecological-system collapse (Holling, 1986). It is also important to maintain the existing stock of ecological biodiversity at a sustainable level; and not just those ecosystems which are of direct use to human production-to-consumption systems.

SOCIAL SUSTAINABILITY

Social sustainability rests on maintaining the vitality of social capital, which encompasses the features of social networks, trust, and norms which facilitate that people jointly pursue shared objectives (Putnam, 1995). Some key elements of social capital include trust, reciprocity and exchange between individuals, common rules, norms and mutually agreed sanctions which may be handed down within a society, and connectedness between networks or groups—including access to wider institutions (Carney, 1999).

Social capital consists of two main components—the institutional and the organizational. The former comprises the laws, norms or policies that govern behavior, while the latter comprises the entities—individuals and institutions—that operate under the umbrella of the institutional framework (Munasinghe, 2010). Munasinghe (2010) argues that social capital is augmented by use unlike ecological and economic capitals, which are depleted by use. Working towards common social goals—such as reducing vulnerability, equity and poverty alleviation—increases social cohesion (Munasinghe, 2010) and, thereby, social capital. This cohesion helps socio-economic systems to remain resilient in times of flux and transition, and also bolsters the coping mechanisms of disadvantaged factions of society (Munasinghe, 2010), thereby minimizing indicators of social unsustainability—such as violence.

Social sustainability prevails when both institutional and organizational components of social capital—and the processes, structures, relationships and systems that constitute them—support present and future generations that are equitable, diverse, inter-connected and democratic (Western Australian Council of Social Service, n.d.). For social sustainability to flourish, development needs to be human-centric. It needs to meet basic human needs such as shelter and food (Streeten, Burki, Haq, Hicks, & Stewart, 1981), afford human freedoms such as social opportunities, political rights, economic facilities, guarantees of transparency and protective security (Sen, 1999), and facilitate human development—thereby expanding economic, social, cultural and political choices and leading to sustainability, productivity and empowerment (Haq, 1999).

ECONOMIC SUSTAINABILITY

The underlying principle of economic sustainability is the maximization of income from a given capital—"a stock of instruments existing at an instant of time" (Fisher, 1906, p. 324)—while at least maintaining the capital which generated this income (Hicks, 1946). The concept of capital extends from economics to the several different types of capitals—including ecological, social and cultural—that economies require to function (Hawken et al, 1999; Munasinghe, 2010).

The spendable income (Repetto, 1985) for an economy depends on the duration for which the capital is to be maintained and for whom—issues of inter-temporal distribution and intergenerational equity (Anand & Sen, 2000; Arrow et al, 2004; Asheim et al, 2001). There is a general agreement on the fact that it is incumbent upon current/existing generations to sustain society's broad stock of capital and productive capacity for future generations (Anand & Sen, 2000; Dworkin, 1981; Rawls, 1971; Sen, 1980). However, it is not clear how to value non-economic capital in monetary units and, therefore, how much of which different types of capitals need to be sustained (Munasinghe, 2010). Dynamic efficiency—in other words, constant non-wastefulness—in production-to-consumption systems, therefore, becomes an imperative proactive measure to remain on the path to economic sustainability (Stavins, Wagner, & Wagner, 2003).

While the concept of economic equity in the future is important, addressing economic equity in the present—intra-generational justice—is even more pressing. Currently, economic progress is judged by financial indications such as the per capita gross domestic product, or the wealth that a community or nation accrues—neither of which reflects the inequity in wealth distribution. The equitable redistribution of a society's economic wealth—including through measures towards poverty alleviation, and related developmental areas of education, and health and nutrition—is not important just from the perspective of deontological ethics. It also has economic consequences, as it raises the productivity of human capital, in turn leading to higher present and future incomes and material prosperity (Anand & Sen, 2000).

Poverty alleviation also helps to safeguard the productive capacity of the ecology, for the present and the future. In the struggle for day-to-day survival—and given their limited access to resources, property rights, finances and insurance—the economically backward are left with little option but to tap ecological resources, often illegally and in an unsustainable manner (Anand & Sen, 2000). The investment in building human capital allows the possibility of earning a living without needing to jeopardize ecological capital (Anand & Sen, 2000), which is an important input to generate economic capital.

CULTURAL SUSTAINABILITY

Cultural sustainability has traditionally been clubbed with social sustainability. However, about two decades ago, several international organizations (Committee on Culture of the world association of United Cities and Local Governments, 2015; European Commission, 2007; European Task Force on Culture and Development, 1997; United Nations Development Program, 2004) and scholars (Hawkes, 2001; Munasinghe, 2010) contended that culture is a distinct dimension of sustainability. In 1995, UNESCO proposed culture as a key dimension of sustainability; and, in 2001, Jon Hawkes popularized it as the fourth pillar of sustainability. Culture has since been included as a key dimension of sustainability in several sustainability paradigms. These paradigms argue that a cultural shift in society's values and the way they are expressed is required to internalize the changes proposed by the new sustainability frameworks (Nurse, 2006)—and, thereby, to achieve sustainability Hawkes (2001)—since culture affects all the dimensions of sustainability (Munasinghe, 1992).

While *culture* is a highly contested term (Hawkes, 2001), cultural anthropologists agree that two of the defining features of a culture are that it is learnt, and that it is shared by a certain community or group of people (Mead & Metraux, 1953). These groups are not only characterized by physical demarcations such as nations and geographies; they also exist at a micro-level within societies as smaller communities which share symbols, heroes, rituals and values (Hofstede, Hofstede, & Minkov, 2010).

Culture encompasses three aspects: namely, values and aspirations or the worldview, the modes of developing and communicating the worldview, and the intangible and tangible manifestations of the worldview (Hawkes, 2001). Cultural capital includes tangible aspects such as artifacts, and intangible aspects such as oral traditions and expressions, bioregional social practices and indigenous knowledge (Moreno, Santaga, & Tabassum, 2004).

Cultural sustainability hinges on the fine balance between preserving culture (United Nations Educational, Scientific and Cultural Organization, 2002) and allowing cultural metamorphosis (Hawkes, 2001). The amalgamation of indigenous cultures—which represent more than 90% of the total global diversity (Gray, 1991)—with state cultures is an inevitable corollary of globalization (Working Group on Culture of United Cities and Local Governments, 2006). While such an intermingling has both pros and cons (Gray, 1991), it is imperative that indigenous cultural capital, with its diversity of histories, geographies, actors and content is safeguarded. This is just as important as preserving biodiversity (United Nations Educational, Scientific and Cultural Organization, 2002). Cultural sustainability is also underpinned by the ability to retain the cultural identity of a people, while simultaneously allowing change to occur in a manner which is mindful of their cultural values (Sustainable Development Research Institute, 1998). Therefore, inclusive and participatory governance in framing and assessing cultural policies is integral to cultural development (Committee on Culture of the world association of United Cities and Local Governments, 2015) and sustainability.

3.4 SUSTAINABILITY PARADIGMS: INTEGRATING THE COMPOUND PICTURE OF SUSTAINABILITY

The preceding section discussed the dimensions of sustainability. Here, we review paradigms that integrate these dimensions into a compound picture. This is important because holistic sustainability is much more than the sum of its parts (Munasinghe, 2010).

Several attempts have been made to elucidate, communicate, model and depict sustainability and sustainable development—including diagrammatically. These diagrams, like most diagrammatic representations and models, reveal the lacunae of their sentential paradigms (Larkin & Simon, 1987). Most understandings of sustainability and their diagrammatic representations depict three dimensions of sustainability—ecological, social and economic. These diagrams locate sustainability or sustainable development at the center of, at the intersection of, or resting on these dimensions (McKeown, 2002).

In 1987, the Brundtland Commission visualized sustainable development as resting on three pillars—social, environment and economy. The diagram (Fig. 3.3) implies that each pillar is equally important, independent, and that together the three pillars support the roof—sustainable development (Mann, 2011). The idea of economic development, social development and environmental protection as independent and mutually reinforcing pillars was echoed in the Earth Summit in 2002, and the outcome document of the 2005 World Summit (Mann, 2011).

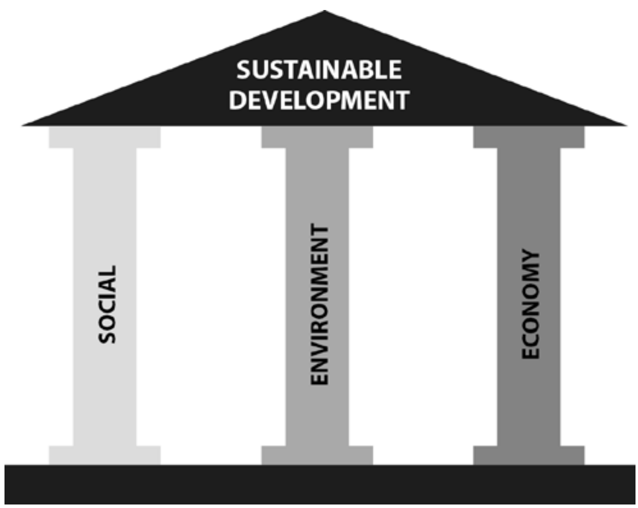

Figure 3.3: Brundtland's Diagram for Sustainable Development (1987)

Several sustainability diagrams—including Barbier's sustainability Venn diagram (Fig. 3.4) which is arguably one of the most recognizable sustainability diagrams—seem to imply that each dimension of sustainability is discrete and can be measured separately (Stanners, Bosch, Dom, Gabrielsen, Gee, Martin, Rickard, & Weber, 2007). The sustainability Venn diagram depicts sustainable economic development at the intersection of the three dimensions of sustainability, thereby representing Brundtland's three separate pillars as interlinked, interrelated and inseparable (Mann, 2011).

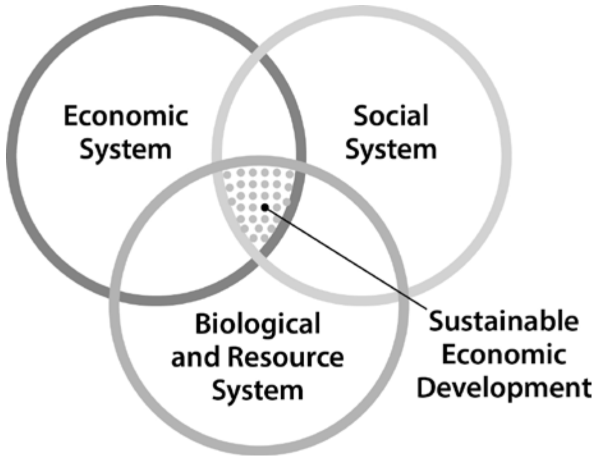

Figure 3.4: Barbier's Sustainability Venn (1987)

Munasinghe's (1992) sustainable development triangle (Fig. 3.5) connects the social, environmental and economic vertices with lines, emphasizing that the interaction between the three pillars is as important as the separate domains.

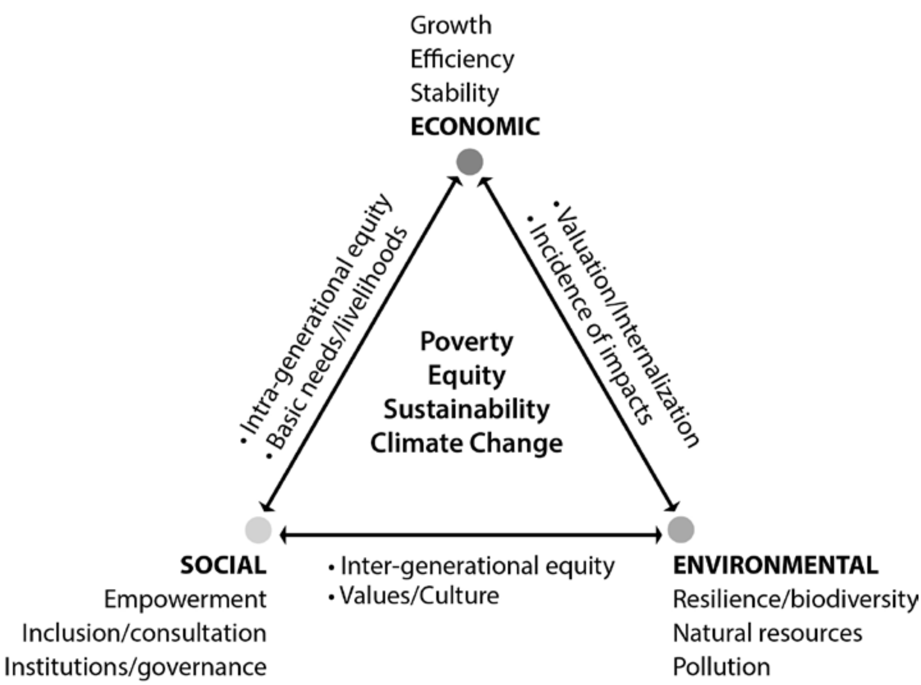

Figure 3.5: Munasinghe's Sustainability Triangle (1992)

Another issue with using a Venn diagram to model sustainability is that the size of the circles seems to indicate the priority of the dimensions (Mann, 2011). Most sustainability Venn diagrams are comprised of equal circles, indicating equal weightage to each of the dimensions of sustainability. These represent *weak sustainability*, since they do not reflect the ecological constraints within which humans and other life forms, economies, and social systems operate (Mann, 2011).

In contrast, *strong sustainability* models—pioneered by Daly's (1996) bull's-eye diagram (Fig. 3.6)—depict the overlapping circles of weak sustainability models as concentric rings, in order to clarify the hierarchy of the dimensions and the dependency between them (Mann, 2011). The innermost ring, the economy, cannot exist without the exchange of goods and services between people in the middle ring—society. Society, in turn, cannot exist without the outermost ring—the environment—which is the source for the air, food and water required for existence, and fuel and raw material required for society's production-to-consumption systems.

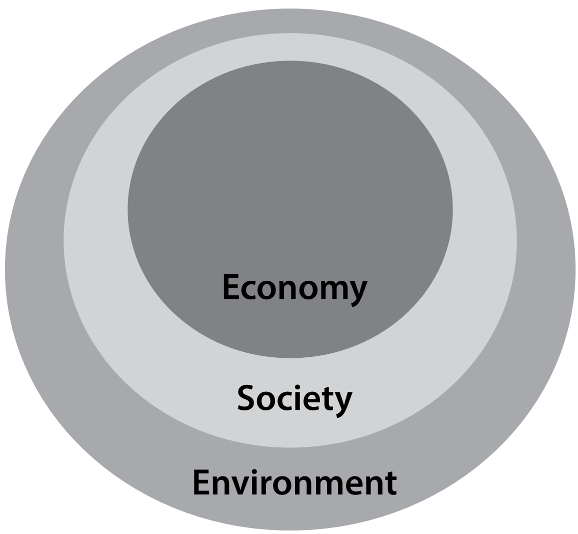

Figure 3.6: Daly's Strong-Sustainability Bull's-eye Diagram (1996)

Increasingly, sustainability models go beyond three dimensions. One such example is the Sustainability Integrated Guidelines for Management (SIGMA) project model (n.d.), which was launched in 1999 by the British Standards Institution, Forum for the Future, and AccountAbility—a leading standards body, a leading charity and think tank devoted to sustainability, and the international professional body for accountability, respectively—with the support of the UK Department of Trade and Industry. The SIGMA project model (Fig. 3.7) replaces the three dimensions with five interlinked and overlapping *capitals*—social, human, man-made, financial and natural—from the World Bank's *capital stock model*. This model resonates with the concept of strong sustainability, as it gives precedence to natural capital by circumscribing all the other capitals within it (Mann, 2011).

Figure 3.7: The SIGMA Project's Five Capitals Sustainability Diagram (2003)

Culture has been factored in as a key dimension in several recent sustainability paradigms. Runnalls (2007) depicted the traditional three-circle Venn diagram circumscribed in the cultural dimension in her holistic systems approach to the four dimensions of community sustainability (Fig. 3.8). While Runnalls's diagram seems to situate the pillars, the cultural dimension seems not to reach the sustainable core (Mann, 2011).

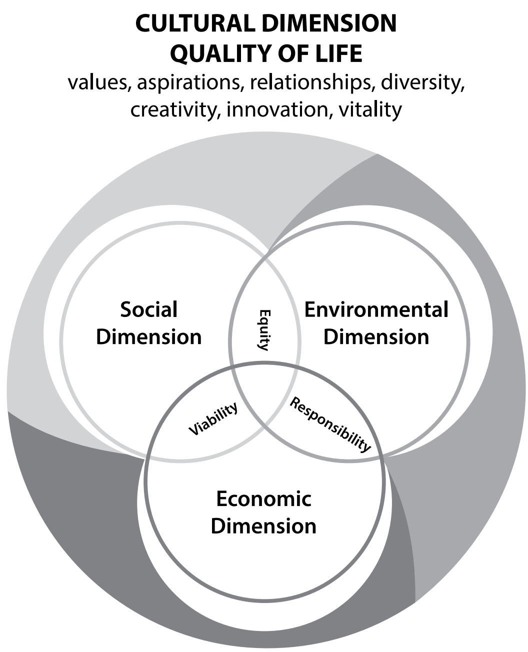

Figure 3.8: Runnalls's Holistic Systems Approach to Community Sustainability (2007)

The four-pillar model seems to call for more organic modeling, as it is difficult to depict more than three dimensions using Venn diagrams (Mann, 2011). A step in this direction is the Local Government Act 2002 of New Zealand, which depicts community sustainability as comprised of four interconnected dimensions (Fig. 3.9)—cultural, environmental, economic and social—with overall well-being at the center (New Zealand Ministry for Culture and Heritage, n.d.).

Figure 3.9: Four well-beings of community sustainability, according to the New Zealand Ministry for Culture and Heritage (2002)

Another attempt to visualize sustainability is by New Zealand's governmental research agency Landcare Research (Fig. 3.10) and Dunham-Jones (2007), who depict sustainability as a braid. This representation shows interlinked social, environmental, cultural and economic dimensions which are stronger when interwoven together; when a single strand frays, it weakens the whole braid (Dunham-Jones, 2007).

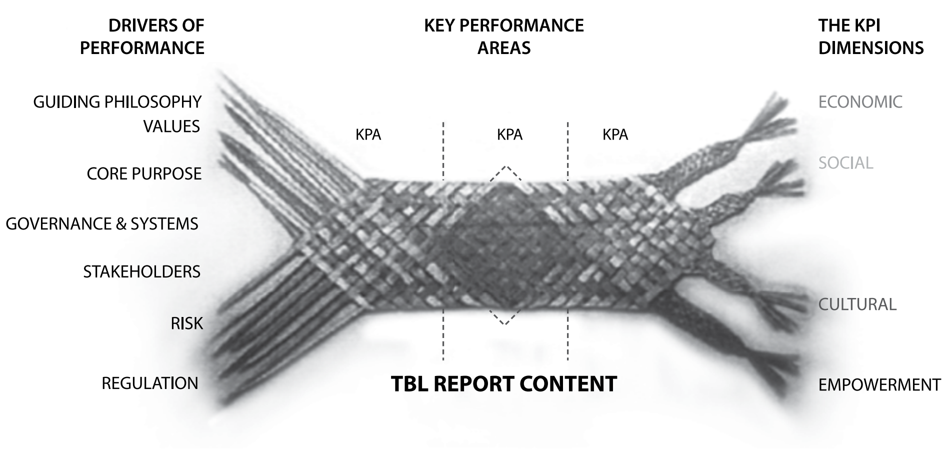

Figure 3.10: Landcare Research-Dunhan-Jones' Braid (2010)

3.5 SUMMARY AND CONCLUSIONS

This chapter began by exploring when, why, how and where unsustainability began. The literature study revealed that unsustainability did not originate at a particular time, and has no discrete cause or geography. It is an emergent process of the anthropocentric development process, underpinned by interconnected production-to-consumption systems. Development through the ages was both cause and effect of incremental development, and of simultaneous incremental unsustainability. The literature review also revealed that development and sustainability affect—and are affected by—multiple dimensions due to the interconnected, integrated systems of our world (Komiyama & Takeuchi, 2006; Shedroff, 2009; Thorpe, 2007). Some scholars explain the differences between growth and development rates of nations at a macro level on the basis of the economic dimension alone (Munasinghe, 1993). However, close examination reveals multiple causality and multiple dimensions at play. Economic behavior is the result of behavioral norms which stem from social conduct (Acemoglu, Simon, & James, 2001; Munasinghe, 2010; North, 1990) and which are orchestrated by a cultural orientation. This interconnectedness points to the fact that efforts to cultivate and maintain sustainable development must rest on a holistic concept of sustainability that is mindful of multiple dimensions.

The increasing human comprehension of sustainability's holistic nature is also evident in the sustainability diagrams we studied that, over time, have included more and more dimensions.

The evolution of these diagrams indicates that we are expanding our understanding of the dimensions of sustainability (Mann, 2011). Over time, the social (people), ecological (planet) and economic (profit) dimensions of sustainability have been supplemented by culture as a vital tenet (Duxbury & Gillette, 2007). In the future, more dimensions may be identified and dimensions that are currently under discussion—such as the political (O'Connor, 2007), temporal and/or ethical tenets—may be formally and commonly accepted. Important subdimensions may also be isolated from the identified umbrella dimensions, from the overall network of connections between systems and entities that influence sustainability.

The prospect of expanding knowledge on sustainability juxtaposed with the fact that the sustainability crisis is real and urgent, and warrants immediate action, points to the importance of basing current sustainability efforts on a paradigm which reflects the current knowledge on sustainability, while being flexible enough to include and be enriched through future knowledge inputs. This flexibility is also relevant because a singular, absolute model defining the relationship, validity and priority of the tenets of sustainability cannot hold true for every situation, since the contexts of problems and their solutions are diverse (Komiyama & Takeuchi, 2006); trade-offs between the tenets are an unavoidable reality. Flexibility in structuring the scholarship and knowledge-base of sustainability according to different situations may itself be a driving force for greater diversity; given that the homogenization of the models of sustainability and the approaches they offer will threaten the diversity of both Earth's regions and cultures, much as economic globalization does now (Komiyama & Takeuchi, 2006).

Therefore, we adopt a broad-based, inclusive and holistic definition of sustainability, which is underpinned by the four-pillar model of sustainability; which is relevant to current knowledge and can contribute to further theory-building. We selected the four-pillar model as scaffolding for our definition of holistic sustainability because its ecological, social, cultural and economic pillars encompass the broad themes contained in current and emerging discussions on holistic sustainability. The four pillars are also congruent with the set of 17 UN sustainable development goals which outline the need for sustainable development to be holistic and balanced (Le Blanc et al, 2012).

Drawing on the literature review, in order to anchor our inquiry, we define *sustainability* as,

A continual process of actualizing "the possibility that humans and other life will flourish on the Earth forever" (Ehrenfeld, 2008, p. 49) by maintaining the balance between different dimensions, including ecological, cultural, social and economic ones.

This definition will guide our research, putting in place a reference point for holistic sustainability, which is an integral constituent of our research questions.

Using this definition of holistic sustainability as a reference point, the following chapter delves deeper into Research Question 1, by exploring the extent to which designers address sustainability in a holistic manner.

04 SUSTAINABILITY BY DESIGN

The previous chapter reviewed literature on sustainability and development, arriving at a definition for holistic sustainability. Here, we present the second of our three-part literature review, which uses this reference point to delve deeper into Research Question 1 (To what extent does design address sustainability holistically—simultaneously considering all of its dimensions including social, economic, ecological and cultural dimensions—while working with non-industrial craft-based MSMEs in developing countries working with renewable materials?) through the literature review on sustainability design.

In 4.1, we explore the emergence of design as a specialized discipline during industrialization, and map how design concerns evolved over time, in line with shifting local and global scenarios. We discuss the role and potential of design to contribute to sustainability in 4.2, and the drivers for sustainability design, in 4.3.

The next section, 4.4, explores existing approaches and assessment methods which position themselves as sustainability-aligned, and which are relevant to designers working towards sustainability design. The section also explores whether these approaches and assessment methods address sustainability in a holistic manner, using the definition of holistic sustainability arrived at in the previous chapter as a reference point. This provides a partial answer to Research Question 1 vis-à-vis sustainability approaches and assessment systems.

Then, in 4.5, we investigate the extent to which designers use sustainability approaches and assessments in order to answer Research Question 1 vis-à-vis sustainability-design practice. We also discuss the barriers to sustainability-design practice here.

The final section of this chapter, 4.6, summarizes the literature review and offers a conclusion towards collating an answer to Research Question 1 vis-à-vis design approaches and assessment systems, and design practice.

4.1 EVOLVING DESIGN CONCERNS: A MIRROR TO DYNAMIC SOCIAL AND HISTORICAL PROCESSES

Papanek's (1971, p. 3) cult book, *Design for the Real World*, opens with the lines, "All men are designers. All that we do, almost all the time, is design, for design is basic to all human activity. The planning and patterning of any act towards a desired, foreseeable end constitutes the design process." However, since "everyone designs who devises a course of action aimed at changing existing situations, into preferred ones" (Herbert, 1969, p. 111), *design* is a highly contested (Julier, 2013), wide-ranging word that spans several disciplines and contexts (Fuad-Luke, 2009; Shedroff, 2009). Design has been classified in many ways including by its several prefixes and suffixes (Fuad-Luke, 2009), and can refer to a process, the output of this process, and also to an aesthetic or pattern (Walker, 1989).

Design is executed by trained, or *professional*, designers as well as by anonymous, or non-intentional, designers (Fuad-Luke, 2009). The prevalent mainstream design paradigm—which centers on the designer, design process and designed products (Walker, 1989), and the understanding that design is predominantly the domain of professional designers—emerged during the industrial revolution (Fuad-Luke, 2009; Walker, 1989). This emergence, and the shifts in design priorities that followed, cannot be examined in isolation; they need to be viewed as part of a larger dynamic social and historical process (Walker, 1989). Interestingly, both design and sustainability concerns—which had existed since time immemorial—crystallized during the industrial revolution.

EMERGENCE OF THE DESIGN PROFFESION DURING INDUSTRIALIZATION

Before industrialization, products were parochially crafted in limited numbers (Walker, 1989). All the processes that were needed to envisage, make and sell a product were vested in a single craftsperson or guild of craftspeople. The industrial revolution divided integrated, artisan-based production-to-consumption systems into specialized disciplines (Dormer, 1997; Walker, 1989)—including design, production and marketing—in line with the concept of division of labor and the pursuit for increased productivity and efficiency (Cusumano, 1991) in Europe and the USA (Walker, 1989). Industrial designers assumed the role of innovators, leaning on a logical design process to visualize big production batches for large, distant markets. Design began to be defined as "the art or action of conceiving of and producing a plan or drawing of something before it is made" (OxfordDictonaries.com, 2016). It was only when designers were able to visualize the process—from concept generation to production—that design became exclusively coupled with industry (Greenhalgh, 1997), and industrial designer was dissociated from craftsperson and artist. Consequently, "late-20th century Western culture saw the separation of 'design' from 'art' and 'craft,' and the separation in 'having ideas' from 'making objects" (Peters, 1997, p. 18).

SOCIAL DESIGN CONCERNS DURING AND AFTER INDUSTRIALIZATION

The Arts and Crafts Movement resisted industrialization, protesting against the social, cultural and ecological evils—unsustainabilities—that it heralded. Proponents of the movement believed craft revival would humanize society by restoring social equilibrium and the cultural ethos of the past. While the movement had little to boast of in terms of concrete achievement, it laid the foundation for future design ideologies that would reflect socialist concerns (Fuad-Luke, 2009). These concerns were evident in the pursuit of archetypical products that equalized their users, typical of Bauhaus design, and, later, in the rationalist, functionalist and modernist design that prevailed until World War II (Fuad-Luke, 2009). In a similar vein, communist ideals—including erasing all forms of social distinction—found expression through design, including by homogenizing fashion (Blaszczyk, 2011).

DESIGN AND CONSUMERISM

The post–World War II generation, weary of one-size-fits-all design, demanded postmodern design pluralism (Fuad-Luke, 2009). With the war depleting manufacturing power in Europe, the USA became the hub of production. This saw the emergence of consumer-led design that celebrated the *American way* (Sheldon & Arens, 1932), which was based on high consumption and fueled by the constant exploitation of natural resources. Budding sustainability concerns were implicit in Sheldon and Arens's (1932) acknowledgment that, while the *American way* might be myopic and might need to draw on the more conservative European approach, "…that time is not yet.... We still have tree-covered slopes to deforest and subterranean lakes of oil to tap with our gushers" (Sheldon & Arens in Whitley, 1932, p. 15). Popular consumer-led design continued to hold its own in the West all through the 1960s, alongside murmurs that design seemed more marketing-led than consumer-led (Whitley, 1993).

DESIGN'S SOCIAL CONCERNS TAKE A BACKSEAT TO ECOLOGICAL CONCERNS IN THE 1970S

The global ecological and social concerns that had been brewing through the 1960s reached crisis point in the 1970s, and affected design as well. Papanek's (1971) book, *Design for the Real World,* urged designers to introspect deeply about how they could contribute meaningfully to global social and ecological issues. Papanek called on designers to be accountable to—and driven by—global ecological and social needs, rather than the consumer-led economy. However, real-life ecological sustainability crises that were unfolding simultaneously seemed to drown out Papanek's call for social design, turning the spotlight almost exclusively onto ecological sustainability in the West. The West Asian oil price-rise crisis of 1973 forced design engineers to give serious thought to ecological issues such as energy efficiency. Life-cycle thinking and life-cycle analysis emerged as a result (Fuad-Luke, 2009). Meanwhile, the social aspect surfaced among the alternative- and appropriate-technology practitioners who mushroomed across the world, proposing alternatives to capital-intensive industrial technology. The movement was popularized by Schumacher's (1973) book, *Small is Beautiful: Economics as if People Mattered*, which had precedents in Gandhi's swadeshi ideology (Bakshi, 1987), which advocated domestic production-to-consumption systems.

GREEN DESIGN IN THE 1980S

Mounting global environmental awareness gave rise to the *green consumer* of the 1980s (Whitley, 1993); this was a driver for *green design*. John Elkington formulated *Ten Questions for the Green Designer,* for a 1986 UK Design Council booklet, inviting reflection on life-cycle thinking and the green consumer (Chapman & Gant, 2007). Design for the Environment (DfE) or *ecodesign* subsumed green design in the 1990s. Ecodesign aimed to create a win-win situation by addressing both the ecology and the economy; it sought to minimize the negative ecological impacts of the product life cycle, while simultaneously offering financial benefits (Brezet & van Hemel, 1997).

THE EXPANDING SCOPE OF DESIGN POST-1990

The scope of sustainability design has expanded over the past 25 years, keeping pace with the expanding understanding of sustainability. Sustainability science has grown to acknowledge and encompass escalating and pressing global issues—including climate change, violence, food security, social responsibility, inclusion and poverty. This has set the stage for an alternative design praxis—including slow design, social design, co-design, meta-design, Design for Sustainability (D4S or DfS), design for the base of the pyramid (BoP), design activism, participatory innovation, and design participation—which looks beyond ecological sustainability (Fuad-Luke, 2009), to address the different and often disparate focal points which together comprise a compound picture of sustainability.

4.2 ROLE AND POTENTIAL OF DESIGNERS TO ACTUALIZE SUSTAINABILITY

Design shapes production-to-consumption systems and, thereby, sustainability. Design decisions orchestrate production-to-consumption systems—including material production and processing, fabrication, distribution, use, repair and maintenance, and end-of-life handling (Waage, 2005)—and thereby determine the flow of materials and human resources (White et al, 2008). These production-to-consumption systems, in part and in whole, and their collateral effects—including environmental, social (White, Stewart, Howes, & Adams, 2008) and cultural spin-offs—shape sustainability.

Sustainability is a *wicked problem* whose solution calls for innovation: "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (Organization for Economic Co-operation and Development Statistical Office of the European Communities, 2005, p. 46). Brezet (1997) proposes four incremental levels of innovation towards sustainability—product improvement, product redesign, function innovation and system innovation. The traditional design function (Cuginotti, Miller, & van der Pluijm, 2008) generally focuses on specific parts of the production-to-consumption system, typically manufacture and use, and therefore does not realize its full potential to impact sustainability at a systems level (Dewulf, 2013)—where the observed reality is the integrated and interacting unicum of phenomena in which the individual properties of the parts of the system become indistinct to comprise the whole system (Checkland, 1997; Jackson, 2003; Weinberg, 2001). The scope of innovation in the traditional design function can be extended from a product level to a systems level (Davis, Öncel, & Yang, 2010; Morelli, 2007), by shifting the desired outcome from the product to be designed to holistic and systemic sustainability (Cuginotti et al, 2008). This can make the shift from designing products, to design the systems that underpin them, or system innovation (Brezet, 1997), thus creating the paradigm shift necessary to move beyond reducing unsustainability, towards proactively creating sustainability (Ehrenfeld, 2008).

Cultivating systemic sustainability calls for the design process to address it earlier on in the front-end stage, instead of waiting to factor it into operational (product-design) activities (Dewulf, 2013). Several consequences of the product life cycle, which need to be *cleaned up*, could be eliminated or minimized by envisaging and addressing them—earlier on at the front-end innovation (Dewulf, 2013) stage, or by replacing a product with a service.

Integrating sustainability concerns from across the value-chain in the front-end stage—through inputs from a team of representatives of the value chain and production-to-consumption system (White et al, 2008)—can also help design to go beyond its typical focus on manufacture and use (Dewulf, 2013). Even though sustainability lies outside the expertise of traditional designers (White et al, 2008), they are ideally placed to facilitate such integrated and multidisciplinary front-end innovation teams; designers' visionary, creative and analytical thinking (Jin et al, 2011) allows them to communicate with a cross section of stakeholders, and synthesize diverse and incomplete inputs and information, while maintaining a strategic overview of the process (Stappers, 2007).

These same qualities allow designers to leverage dynamic and complex systems and scenarios—such as those at the intersection of sustainability and globalized production-to-consumption systems in flux—as opportunities for innovation. Unfolding scenarios lead to new socio-economic and cultural patterns, which translate into uncharted market potential—including for non-mainstream, niche products and systems with high social and cultural value (Morelli, 2006). The combination of generative and evaluative thinking (Stappers, 2007) allows designers to explore these evolving intersections of culture and market, because they can intuitively decipher the basis of emotions, values and meanings, and communicate abstract information (Maxwell, Sheate, & van der Vorst, 2003).

This skill set—visionary, creative and analytical thinking (Jin et al, 2011) and the combination of generative and evaluative thinking (Stappers, 2007)—also allows designers to look beyond accommodating existing needs, towards designing with the intention of influencing people to behave sustainably (Lockton, 2013)—design for sustainable behavior (Bhamra, Lilley, & Tang, 2008; Lockton, 2013; Wever et al, 2008). Bhamra et al (2008) outline seven strategies of design for behavioral change: a) eco-information (encouraging consumers to make sustainable decisions by providing them with understandable sustainability information),

b) eco-choice (enabling consumers to make sustainable decisions by providing them with sustainable options), c) eco-feedback (enabling consumers to make sustainable decisions by providing them with feedback on the sustainability of their actions), d) eco-spur (enabling consumers to make sustainable decisions through rewording, so as to prompt sustainable behavior or punish unsustainable behavior), e) eco-steer (ensuring consumers adopt sustainable decisions through features embedded in the product design), f) eco-technical intervention (ensuring consumers adopt sustainable decisions by controlling their behavior through design combined with advanced technology), and, g) clever design (to ensure the consumer acts sustainability without raising their awareness or changing their behavior, purely through product design). Each of the strategies incrementally shifts control from the user to the designed product (Lockton, 2013); the highest level is *clever design*, where products "automatically act environmentally or socially without raising awareness or changing user behavior" (Bhamra et al, 2008, p. 8).

The possibility of shaping production-to-consumption systems towards sustainability challenges designers to create a counter-narrative (Fuad-Luke, 2009) that seeks to pro-actively actualize holistic sustainability and to step out from their traditionally values-agnostic orientation (White et al, 2008) into the role of an activist (Thorpe, 2007). This possibility is more realizable than ever, since the scope of design has expanded over time and its current scope positions designers to address larger issues—including sustainability. Valtonen (2005) describes the expansion of the designer's role in Finland over time: Initially likened to an artist, the designer became a core part of the industrial team alongside the engineer and marketing experts in the 1960s. In the 1970s, Finnish design became engrossed with user-centric issues, including ergonomics; in the 1980s, with design management and, in the 1990s, with brand-building and strategic design. In the new millennium, the focus of Finnish design is shifting towards creating a market edge in the rapidly globalizing world through new innovation. Valtonen's description of the Finnish design journey resonates with the expanding scope, role, and power of designers the world over. More than ever before, designers are in the position to go beyond a traditional focus on manufacture and use, and have a say as key players in strategic decisions that will determine production-to-consumption systems—and thereby sustainability—around the world (British Design Council, 2004; Swedish Design Industry, 2004).

4.3 DRIVERS FOR SUSTAINABLE DESIGN

The previous section explored the potential for designers to impact sustainability—including by assuming the mantle of sustainability activists. This section gives an overview of the external pull—the drivers—for designers to pursue design aligned to sustainability. A detailed discussion on these drivers is offered in Chapter 11.

REGULATORY AND NON-REGULATORY FRAMEWORKS

The drivers for sustainable design can come from within the company for which the designer works, or can be external stimuli (Dewulf, 2013). One of the strongest external drivers for sustainable design is the growing importance of sustainability in the business landscape, and the consequent emergence of regulatory and non-regulatory sustainability frameworks (van Hemel & Cramer, 2002; White et al, 2008). Businesses are being pressured to incorporate sustainability into their activities by different nodes of the value chain (PwC, n.d.; White et al, 2008). Policy and regulatory frameworks by governments—including those that demand compliance with labor and material standards—are increasing in both number and stringency (PwC, n.d.; White et al, 2008). Failure to comply can mean the loss of future business, and even reversal of existing business by way of product recalls (PwC, n.d.; White et al, 2008).

MARKET DEMAND AND ACCESS

A seemingly stronger external driver is demand (Mate, 2006; van Hemel & Cramer, 2002). Increasingly, urban consumers in both the developing and developed world—informed by product boycotts, media and NGO campaigns—are demanding product transparency (White et al, 2008). Driven by this, a plethora of companies are implementing green labeling, branding and marketing schemes. This pressures their competitors to follow suit in order to protect their market share and also to tap into the widening sustainability-aligned consumer segments (White et al, 2008)—such as Lifestyles of Health and Sustainability (LOHAS) market sectors of personal health, green-building, ecotourism, natural lifestyles, alternative transportation and alternative energy (Lohas Group, n.d.). This is affecting businesses; importers now demand integrated product audits (Social Compliance Initiative, 2015) which examine one or more factors, especially environmental factors (no lead paints, azo dye detection, etc.) towards citizen protection (low emissions and low voltage). All of these compel businesses, and thereby design, to view sustainability not only as a market niche, but as a matter of market access (White et al, 2008).

SUSTAINABILITY AS A BUSINESS OPPORTUNITY AND USP

The drivers for a company to progress towards sustainability tend to move from external to internal over their sustainability journey. Willard (2002) outlines five incremental stages of sustainability for a company—pre-compliance, compliance, beyond compliance, integrated strategy and purpose/passion. At the pre-compliance stage, the company's unsustainable actions are illegal and do not meet existing legislation. At the second stage, compliance, the company makes sure it fulfils its legal obligations towards sustainability by doing the bare minimum. At Stage 3—beyond compliance—the company realizes that reducing unsustainability over the value chain by increasing efficiency also translates into saving money. At Stage 4—integrated strategy—the company begins to include sustainability in its business strategies and goes beyond seeing unsustainabilities as bottlenecks, to seeing them as business opportunities and potential competitive advantages. In the final stage—passion/purpose the company looks beyond reducing unsustainability to actively creating sustainability. At this stage, the company looks beyond increasing business by doing the right thing, to using their business as a vehicle to create sustainability holistically, which in turn will benefit their business opportunities.

4.4 DESIGN APPROACHES AND ASSESSMENT SYSTEMS AIMED AT ACTUALIZING SUSTAINABILITY

In 4.3, we discussed how the changing business landscape has led to the emergence of drivers for sustainability design, and in 4.2, we saw how designers are ideally placed to leverage these opportunities. This section explores existing sustainability-aligned approaches and assessment systems, which can act as scaffolding for designers in their sustainability-design practice.

Of the several approaches and assessment systems we studied, only those seminal approaches which position themselves as aiming to actualize sustainability are discussed below. This is because every design approach or assessment system can be more or less aligned to sustainability, based on the design problem and also based on each individual designer's agency and propensity to practice sustainability design. Since classifying the suitability of existing design approaches and assessment systems towards being used for sustainability design was beyond the scope of our research, we limited ourselves to only those with clearly stated sustainability-related intentions.

SUSTAINABILITY APPROACHES

Natural Capitalism

The Natural Capitalism Framework (Hawken et al, 1999)—also known as eco-efficiency (Schmidheiny, 1992)—centers on the efficient use of natural, human, manufactured and financial capital. The framework advocates radical resource productivity (increasing the productivity of natural resources), ecological redesign (shifting to biologically-inspired models), service and flow economies (shifting emphasis from products to services), and investing in natural capital (to build a strong resource base of finite natural resources) (Hawken et al, 1999). Natural capitalism is broad, and while this makes it easy to understand, it does not address some aspects of production-to-consumption systems—such as waste—in sufficient detail (Shedroff, 2009). This approach does not address the social and cultural aspects of sustainability.

Cradle-to-Cradle

The Cradle-to-Cradle Framework (Stahel, McDonough, & Braungart, 2002)—also known as C2C, or eco-effectiveness—focuses on closed-loop material flow of both technical and natural materials. C2C argues that products in the biosphere must be bio-degradable, and materials in the technosphere should be continuously up-cycled (Stahel et al, 2002). Its key principles are materials health (safe materials that can be constantly recycled), materials reutilization (all materials must be constantly recycled), renewable energy (100% of energy used during product use and manufacture must be renewable), water stewardship (water must be managed so as to be clean), and social fairness (high labor standards) (Wever & Vogtländer, 2015). Some critics of C2C argue that it is biased towards technical materials and technological solutions, as opposed to natural materials and traditional technologies (Shedroff, 2009). Others argue that C2C is too simplistic to be applied to complex products (such as consumer electronics), which is evident in the fact that such examples are absent from the C2C roster (de Man & Brezet, 2016). Neither does C2C account for the cost–benefit analysis of the energy and resources used in converting *waste* into usable material streams, nor the potential negative side-effects of natural nutrients being absorbed into ecosystems in the wrong quantities or locations (de Man & Brezet, 2016). While the C2C framework offers detailed criteria and is accompanied by a tedious and stringent certification process (Shedroff, 2009), it calls for significant research and investments for new material-technologies. C2C does not address sustainability's social and cultural aspects—including local production-to-consumption systems (Shedroff, 2009).

Biomimicry

Biomimicry (Benyus, 2002) centers on creating sustainable materials, products, services and systems based on examples found in nature (Shedroff, 2009). The approach inspires designers to use nature as model, measure and mentor (www.biomimicry.net, 2015). Biomimicry goes beyond mimicking technical solutions from nature (biomimetics), to mimicking nature at a systems level, such as the concept of closed material loops (Wever & Vogtländer, 2015). The Biomimicry Design Spiral is designer-friendly, as it presents biomimetic principles in a format similar to the generic contemporary design process (Shedroff, 2009). Biomimicry also proposes *Life's Principles*—a checklist of design lessons from nature (Wever & Vogtländer, 2015). These include adapting to changing conditions, being locally attuned and responsive, using life-friendly chemistry, being resource efficient, integrating development with growth, and evolving to survive. Since the Biomimicry Approach is non-anthropocentric and is nature-focused (Shedroff, 2009), it mainly addresses ecological sustainability. It does not address the social, economic (Shedroff, 2009), or cultural aspects of sustainability.

Ecodesign

Ecodesign or Design for Environment is an approach which introduces ecological criteria—with the aim of reducing the environmental impact of products at every stage of their life cycle, towards more sustainable production and consumption—alongside traditional product design criteria, such as functionality, ergonomics and quality (van Hemel, 1998). Ecodesign goes beyond a product-centric focus to look at reducing the environmental impact of systems and services as well (Sherwin & Evans, 2000). As one of the earliest sustainability frameworks, Ecodesign now has several tools including guidelines, checklists and handbooks, screening/management methodologies and tools, and linked life-cycle assessments and databases (Fraunhofer IZM, 2005). Ecodesign began by addressing end-of-pipe issues, and over time progressed to clean production, and then on to the entire lifecycle (van Hemel, 1998). While later ecodesign projects aimed to optimize the entire socio-economic system of the product, the approach's original economic and ecological focus has prevailed as a priority (Diehl, 2010)—increasing prosperity while decreasing environmental costs. Ecodesign does not address the social and cultural dimensions of sustainability.

Design for Sustainability

Design for Sustainability (D4S) or Sustainable Product Design is an approach that addresses social, ecological and economic sustainability (Crul & Diehl, 2010) and addresses sustainability assessment and business generation for emerging markets. Design for Sustainability includes three levels of innovation for products and systems—incremental, radical and fundamental; and three sub-approaches to these—redesign, new product development and product service system (Crul & Diehl, 2010). The D4S redesign approach comprises 10 steps with corresponding tools to facilitate these, including an impact-assessment matrix, D4S strategies and rules of thumb. The D4S approach also has a mechanism to compare the finished redesigned product with the original, so as to map the efficacy of the sustainable-design input (Crul & Diehl, 2010). This approach also presents tools to facilitate policy formulation and business creation (Castillo, Diehl, & Brezet, 2012). It is an upgrade of Ecodesign, which is perhaps why it retains an ecological priority, and addresses economic, ecological and social factors. However, it needs to address a larger spectrum of social issues and include cultural issues in its format to address sustainability holistically.

Circular Economy

Circular Economy is a framework that draws on principles from Biomimicry, Industrial Ecology, Cradle-to-Cradle, and Blue Economy (Ellen MacArthur Foundation, 2013) towards creating an industrial economy which produces no waste or pollution, with separate biological and technical nutrient flows. The concept advocates looking at the systemic picture, rather than focusing on its separate components. The methods to realize a circular economy include methods from the approaches on which it draws, and also from newer approaches such as ReSolve—regenerate, share, optimize, loop, virtualize and exchange (Zils, 2014). Newer strategies towards the circular economy also include creating longer-lasting products (Bakker & den Hollander, n.d.).

Since the circular economy draws on approaches with an ecological and economic focus, it retains their priorities. It fails to address cultural issues, and addresses social issues only to a limited degree (de Man & Brezet, 2016).

Design for the Base of the Pyramid

The base of the pyramid (BoP) consists of more than 4.5 billion economically-challenged people, who have limited access to products and services that satisfy basic needs—including adequate food, shelter and access to clean water (Prahalad & Hart, 2002). Design for BoP clients involves developing simple, functional and potentially open-source solutions, which can transform their lives—including by enabling them to become self-reliant and empowered entrepreneurs (Smith, 2007). Several BoP approaches involve the client in the design process—including co-creation and participatory design. However, most of these are still at a formative stage (Castillo et al, 2012). Most BoP approaches focus on the social aspect, and also on the livelihood issue (economic dimension). BoP does not address ecological issues or cultural issues.

SUSTAINABILITY ASSESSMENT SYSTEMS

Life-Cycle Assessment

Life-Cycle Assessment (LCA) examines the materials and energy consumed, and emissions produced throughout the product's life cycle—including extraction of raw material, processing of materials, manufacturing of components, assembly and packaging, installation and use, service, upgrading and maintenance, and disposal and recycling. The selection of the system being analyzed, its boundaries and its functions, is very important as this determines the inputs into the assessment, which directly affect the output or result (Wever & Vogtländer, 2015).

There are two ways of conducting LCAs. The classical (Wever & Vogtländer, 2015) and resource-intensive (White et al, 2008) process-based LCA calculates the materials, energy and emission at each node of the production-to-consumption system or process (Shedroff, 2009). This makes it impossible to use unless the product exists, ruling out its use for the design-and-development stage (Shedroff, 2009).

The *fast-track* (Wever & Vogtländer, 2015) economic input–output LCA (EIO-LCA) model uses proxy data from reliable sources instead of measuring this first-hand, making it cost- and time-effective (White et al, 2008), but not necessarily as accurate as the process-based LCA model (Shedroff, 2009). The main steps of the EIO-LCA are establishing the scope and goal of the analysis, establishing the system, functional unit and system boundaries, quantification (of materials, energy, etc.), entering and calculating data, and interpreting data (Wever & Vogtländer, 2015).

LCA focuses primarily on ecological analysis (Shedroff, 2009). It fails to address social (Finkbeiner, Shau, Lehmann, & Traverso, 2010; Lehmann, Russi, Bala, Finkbeiner, & Fullana-i-Palmer, 2011), economic and cultural issues.

Life-Cycle Costing

Life-Cycle Costing (LCC) is an aggregation of all the costs which are directly related to a product over its life cycle. There are different variations of LCC applicable to different sectors and products: conventional LCC assesses internal costs and benefits to the organization; environmental (Hunkeler, Lichtenvort, & Rebitzer, 2008) LCC additionally assesses external costs and benefits which are anticipated to be privatized; and societal LCCs—which are still in their nascent stage—are supposed to assess private and external societal costs (United Nations Environment Programme, 2009). LCCs are usually carried out in four phases—defining the goal, scope and functional unit; calculating inventory costs; arriving at aggregate costs by cost categories, and interpretation of results (United Nations Environment Programme, 2009). The definition of data availability and quality assessment, cost categories, and assurance are all challenges for the LCC approach (United Nations Environment Programme, 2009).

LCC focuses primarily on economic analysis (United Nations Environment Programme, 2009). It does not address social (Lehmann et al, 2011; Finkbeiner et al, 2010), economic and cultural issues.

Social Life-Cycle Assessment

Social Life-Cycle Assessment (S-LCA) assesses the social and socio-economic aspects of products throughout their life cycle. S-LCA emerged from the growing critique that LCA needed to include social aspects (Lehmann et al, 2011; Finkbeiner et al, 2010). The UNEP Guidelines for Social Life-Cycle Assessment of Products (United Nations Environment Programme, 2009) summarize existing methodologies and approaches and include methodological sheets (Finkbeiner et al, 2010). These documents outline attributes to be assessed which are socially relevant, the indicators for the analysis and the recommendations for data assessment against five main categories of stakeholders—workers/employees, the local community, society (national and global), consumers and the value-chain actors (Life-cycle Initiative, n.d.). S-LCA needs to be integrated with mainstream LCA approaches, and cultural aspects need to be included towards addressing sustainability holistically (Finkbeiner et al, 2010).

Life-Cycle Sustainability Assessment

The Life-Cycle Sustainability Assessment (LCSA) combines three life-cycle techniques with similar frameworks—LCA, S-LCA and LCC (Valdivia, Ugaya, Hildenbrand, Traverso, Manzin, & Sonnemann, 2013)—to arrive at an overarching assessment of a product system that reflects both negative and positive impacts (Ciroth, Finkbeiner, Idenbrand, Klöpffer, Mazijn, Prakash, Sonnemann, Traverso, Ugaya, Valdivia, & Vickery-Niederman, 2011). The LCSA methodology includes a life-cycle sustainability dashboard which ranks totals obtained for LCA, LCC and S-LCA ratings, and enables the comparison of products based on scores and colors (Ciroth et al, 2011). The LCSA is still in its nascent stages, including its methodology, criteria, and interpretation of results (Valdivia et al, 2013).

Eco-costs/Value Ratio

The Eco-costs/Value Ratio (EVR) is an indicator which helps calculate both the environmental costs of a product or service and its value (Vogtländer, 2011). When two products are compared through tools for ecological assessment, such as LCAs, it is assumed that the two products are identical in terms of market value. However, products with the same eco-cost may have different market values, and products which have the same market value may have differing eco-costs. EVR therefore evaluates both—the eco-cost and market value—in order to offer the best cost–benefit analysis. This enables an assessment of maximum value for the end-user with the minimum environmental burden. Unlike the classical LCA, which can only be applied to a finished design, EVR can also be applied during the early stages of design to assess the feasibility of the proposed design using estimated data on costs and market value. This possibility helps designers strike a balance between perceived product value and environmental costs resulting in strategic design which is mindful of the fact that green products and services need to offer good value to buyers in order to be viable in a free-market economy (Hendriks, Vogtländer, & Jansses, 2006). EVR focuses on both economic and ecological issues but does not address social and cultural issues of sustainability.

COMPARISON OF SUSTAINABILITY APPROACHES AND ASSESSMENT SYSTEMS VIS-A-VIS THE DIMENSIONS THEY ADDRESS

In Fig. 4.1, we investigate the extent to which the approaches and assessment systems address sustainability holistically. The reference point for *holistic sustainability* was derived from the definition arrived at in the previous chapter; it indicated that, for sustainability to be holistic, it needs to address multiple dimensions including ecological, cultural, social and economic ones. The current and proposed design focus vis-à-vis sustainability's tenets are depicted in Fig. 4.2.

APPROACH	ECOLOGICAL SUSTAINABILITY	ECONOMIC SUSTAINABILITY	SOCIAL SUSTAINABILITY	CULTURAL SUSTAINABILITY
SUSTAINABILITY APPROACHES				
Natural Capitalism	●	●		
Cradle-to-Cradle	●	●		
Biomimicry	●			
Ecodesign	●	●		
Design for Sustainability	●	●	●	
Circular Economy	●	●		
Design for the base of the pyramid		●	●	
SUSTAINABILITY ASSESSMENTS				
Life-Cycle Assessment	●			
Life-Cycle Costing	●			
Social Life-Cycle Assessment			●	
Life-Cycle Sustainability Assessment	●	●	●	
Eco-costs/ Value Ratio	●	●		

Figure 4.1: The extent to which sustainability-aligned approaches and assessment systems address sustainability holistically (Reubens 2016)

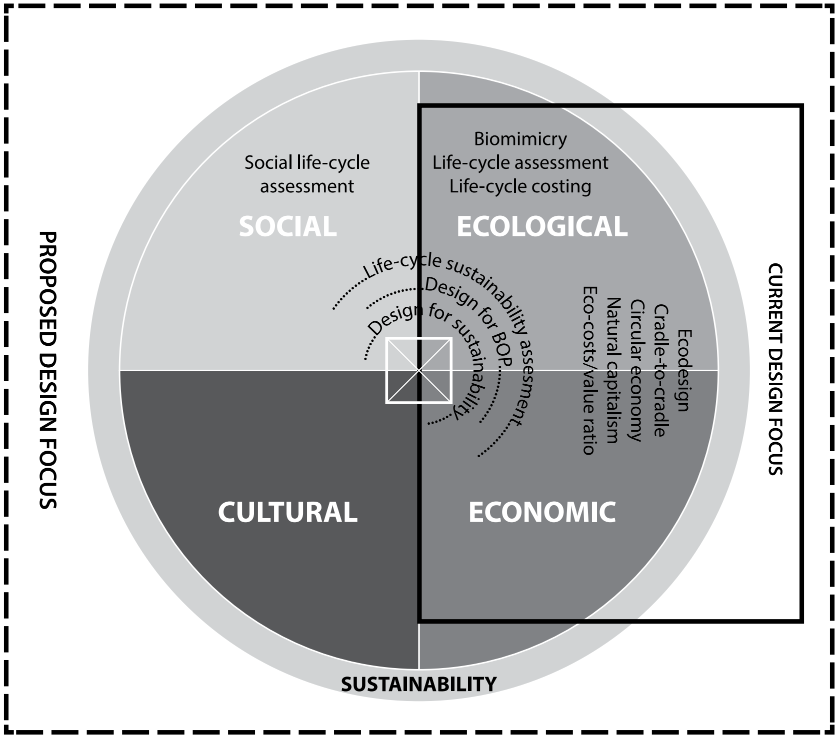

Figure 4.2: Current and proposed sustainability design focus vis-à-vis sustainability's tenets (Reubens 2016)

4.5 THE GAP BETWEEN SUSTAINABILITY THEORY AND PRACTICE

The sections above indicate that sustainability is growing in importance in the business landscape, that designers are ideally positioned to leverage the opportunities this presents, and that there are sustainability approaches and assessment systems available towards sustainability-design practice. Despite all of these opportunities, the interest in sustainability and sustainable design (Fuad-Luke, 2009) has not translated into frequent practice by designers in either developed (Aye, 2003; Kang et al, 2008; Kang & Guerin, 2009; Mate, 2006) or developing countries (Hankinson & Breytenbach, 2012). While there is a paucity of literature on the percentage of design practitioners who use sustainable design strategies and approaches (Bacon, 2011), the several studies which center on the barriers to sustainable design implicitly indicate that there is a deficit of sustainability-design practice vis-à-vis potential. Some of the key thematic areas in the barriers to sustainable design emerging from these studies are as below:

LACK OF KNOWLEDGE ABOUT SUSTAINABILITY

Designers' knowledge and understanding of sustainability shapes their sustainable design values; and, thereby, their behavior and the likelihood of their designs being mindful of formal and informal sustainability regulatory frameworks (Hankinson & Breytenbach, 2012). Designers need to understand the specific characteristics of sustainability and sustainable design, in order to apply them (Kang & Guerin, 2009). However, most designers do not learn about sustainability through their mainstream design education (Aye, 2003; Hankinson & Breytenbach, 2012), through their professional practice, or through professional peer-exchange platforms such as conferences (Hankinson & Breytenbach, 2012). Consequently, they lack knowledge on sustainability—including on sustainable materials (Mate, 2006), their impact (Kang & Guerin, 2009) and sourcing (Hankinson & Breytenbach, 2012). Incidentally, designers who have a greater knowledge of eco-materials seem to use them more frequently (Mate, 2006).

Designers aiming to learn more about sustainability through literature are shortchanged as well, since most design literature cites *ecodesign* as an umbrella term for sustainable design. Consequently, designers practicing sustainable design tend to focus on the ecological tenet and not on the holistic picture (Maxwell et al, 2003). In order to factor sustainability holistically into their designs, designers need to understand it as a systemic construct resting on interconnected tenets. Designers need to appreciate the links between the tenets and, better still, understand them (Shedroff, 2009).

LACK OF OVERVIEW ON PRODUCTION-TO-CONSUMPTION SYSTEMS AND VALUE CHAINS

Limiting design focus to the company—rather than including the forward and backward linkages that comprise the entire production-to-consumption system—is a barrier to sustainable design (Maxwell et al, 2003). Task specialization and division of labor have led designers, like other actors in the industrial production-to-consumption system, to lose sight of the systemic picture. Because of this loss of overview, designers tend to address easily apparent problems—such as various forms of ecological unsustainability—rather than exploring integrated issues and reaching holistically sustainable systems solutions (Maxwell et al, 2003). The difficulty in maintaining a holistic overview is increased with production-to-consumption systems being spread across nations and geographies, compounding the difficulty in assessing the reliability of product suppliers and manufacturers (Hankinson & Breytenbach, 2012).

FAILURE TO INCLUDE SUSTAINABILITY AT A STRATEGIC LEVEL IN THE OVERALL APPROACH

The failure to incorporate sustainability at a strategic level inhibits sustainability concerns from becoming an inherent part of an organization's key business systems—including design (Maxwell et al, 2003). Designers lack motivation to practice sustainable design because of resistance from their organizations (Bacon, 2011). One reason for this is the lack of clarity on the benefits (van Hemel & Cramer, 2002)—especially the immediate ones—of sustainable design. Sustainable solutions sometimes cost more (Aye, 2003; Mate, 2006) and involve more time (Aye, 2003; Bacon, 2011; Hankinson & Breytenbach, 2012; van Hemel & Cramer, 2002) for sourcing (Aye, 2003) and research

(Hankinson & Breytenbach, 2012). Innovative solutions sometimes mean looking beyond the product being designed, to the larger picture—including the possibility of a product–service combination (Maxwell et al, 2003). For it to be factored into innovation and design, sustainability needs to be championed as a key part of an organization's strategic approach—even if it is perceived as requiring extra effort for benefits that may not be immediately clear (Hankinson & Breytenbach, 2012).

FAILURE TO INCLUDE SUSTAINABILITY CRITERIA IN THE DESIGN BRIEF

If sustainability is included in the design brief, it can be factored in early on in the design process, in the front-end stage (Dewulf, 2013). This would minimize the need to *clean up* several consequences of the product life cycle (White et al, 2008), and would offer the most potential to factor sustainability into the production-to-consumption system. However, in reality, sustainability is not frequently included in design briefs alongside traditional criteria such as market, customer, and quality and production feasibility. Sustainability is seen as an expensive (Aye, 2003; Bacon, 2011; Mate, 2006) add-on to the design brief—and one that conflicts with the functional requirements of the product (Hankinson & Breytenbach, 2012; van Hemel & Cramer, 2002)—rather than being an integral part of it. This could be because sustainability is not yet frequently required by legislation (van Hemel & Cramer, 2002) and is rarely insisted upon (Hankinson & Breytenbach, 2012). Client resistance (Aye, 2003), client knowledge (Davis, 2001), and the perception that sustainable products are not yet needed by clients (van Hemel & Cramer, 2002) are also reasons why sustainability is not included in the design brief. Another reason is the lack of knowledge and understanding of sustainability on the part of the designers themselves, which we discussed in the first part of this section.

LACK OF A COLLABORATIVE DESIGN PROCESS

Sustainable innovation requires going beyond design's typical focus on manufacture and use (Dewulf, 2013), to integrating sustainability concerns and opportunities from the different nodes of the value chain and the production-to-consumption system (White et al, 2008). It is not just the designer, but the different functional units within the organization that shape the final design and, thus, the manner in which it impacts sustainability (White et al, 2008). Sustainability is also affected by the different occupational groups and stakeholders across the supply chain (White et al, 2008). Therefore, collaborators from within and outside the organization are needed to enrich the innovation process; these may be actors and groups who may not traditionally be part of the innovation team (White et al, 2008). Communication and coordination between these multidisciplinary collaborators is challenging, due to the different jargon used (Maxwell et al, 2003) by different disciplines and also in terms of determining when and how to factor in diverse viewpoints (White et al, 2008). The lack of collaborators in terms of in-house experts (Aye, 2003) who can support designers practically, into incorporating industry requirements vis-à-vis sustainability—which traditionally lies outside the traditional domain of design (Maxwell et al, 2003)—is another barrier for the practice of sustainable design.

LACK OF TOOLS

Studies among designers revealed that the lack of appropriate tools is a barrier to sustainable design (Aye, 2003). Several of the existing tools are misaligned with design requirements (Lofthouse, 2006) as they focus on cleaning up the life cycle and do not support the front-end innovation process (Walker, 1998)—which holds the greatest potential for design to factor in sustainability. While several existing tools outline issues related to sustainable design (Lofthouse, 2006) and provide insights on the process and outcomes of designing sustainably (White et al, 2008), designers were not clear on how to put them into practice (Lofthouse, 2006). Designers wanted tools that had accurate and accessible information (Aye, 2003; Davis, 2001; Hes, 2005) packaged together in a manner which made referring to them easy and not tedious (Lofthouse, 2006).

Designers also cited the difficulty in measuring sustainability as a barrier (Bacon, 2011), and added that clients unwilling to invest in sustainable design—due to its immediate additional cost—might be convinced if its long-term economic savings could be quantified (Hankinson & Breytenbach, 2012). Tools to quantify sustainable-design achievements and communicate them through different mechanisms, such as ratings, could help legitimize sustainability efforts as credentials (Hankinson & Breytenbach, 2012).

FAILURE TO KEEP DESIGN TEAM IN THE LOOP DURING PRODUCT ACTUALIZATION

A barrier to sustainable design is the fact that designers do not perceive including or achieving sustainability as their responsibility (van Hemel & Cramer, 2002). While it appears that the designers should be responsible for sustainability, given that the innovation process is vested with them, the final design is actually the result of several iterations by different functional groups—including design, production, marketing, and merchandizing (White et al, 2008). This is because, in several companies, different processes—including the innovation and design process—have been divided among different functional groups for efficiency (White et al, 2008). Each of these functional groups receive an iteration by the previous group working on the product and after doing its iteration, “throw designs over ‘a wall’ without understanding the upstream and downstream implications” (White et al, 2008, p. 4) to the next functional group in the design pipeline. Often, these groups do not communicate with each other on the iterations. So, even if a functional group—including design—tries to factor in sustainability, another functional group may not be mindful of this, and might make changes that reverse or lessen these considerations in its iteration (White et al, 2008).

In the end, none of the functional groups takes ownership or accountability for the final design outcome, because none of them was involved with design decisions before or after they threw it *over the wall*. Unless designers are kept in the loop from the front-end stage, right up to final product actualization, they cannot maintain their vantage view of the process (White et al, 2008), and therefore will not take responsibility for the outcome.

4.6 SUMMARY AND CONCLUSION

This chapter aimed to provide a partial answer to Research Question 1, specifically, to what extent do designers address sustainability holistically? In order to situate the subject, evolving design concerns were mapped against unfolding world phenomena. This exercise revealed that design concerns have mirrored and responded to unfolding human processes and concerns—including to expanding sustainability concerns. The growing importance of these concerns has, in turn, changed the business landscape, giving rise to sustainability design drivers including market demand and regulatory and non-regulatory frameworks. Designers are ideally placed to actualize the opportunities offered by these drivers due to their inherent set of skills, and the expanding scope, role, and power of the design-professional the world over.

We studied and analyzed existing sustainability approaches and assessment methods which can underpin designers' sustainability design practice with regards to how holistically they approached sustainability. We arrived at the reference point for this in the previous chapter, which indicated that, in order to address sustainability holistically, ecological, cultural, social and economic tenets need to be considered. The analysis revealed that, while all the approaches and assessment systems prioritized the economic and ecological aspects of sustainability—with the exception of BoP and SLCS, which prioritized the social dimension—none of them looked at sustainability in a holistic manner. However, the fact that the newer and hybridized frameworks and assessment systems—including design for sustainability, life-cycle sustainability assessment and EVR—increasingly recognize and attempt to address multiple factors, while retaining their economic and ecological precedence, seems to confirm our argument for the need and gap for a holistic sustainability approach and assessment system. The evolution of the original LCA—among the few inter-subjective ISO certified tools—to the SLCA which looks at social issues, and then on to the LCSA, which attempts to address ecological, social and economic dimensions together, also points to this gap and need.

Interestingly, all of the approaches and assessment systems studied were created in the developed world. The eco-centricity of these approaches, and their focus on the reduction of eco-impacts, could likely be due to their origin in the developed-world context—characterized by sufficient income and social security, but enormous consumption. While the BoP approach was also created in the developed world, it gave precedence to the social aspect—and little attention to the ecological aspect—as it reflects the developing world's low-resource setting and priorities. Culture has not so far been addressed in the developed-world context. The cultural dimension is beginning to be addressed in the developing world, where there are issues of indigenous representation and traditional cultural industries—such as the handicraft sector—being endangered due to development and the resultant globalization. Our research surmises that, while an approach would need to address all the dimensions of sustainability in order to be holistically sustainable, an innate bias towards situational priorities may be inevitable and practical—in line with the *think global, act local* logic.

Based on our findings from this literature review, we can address Research Question 1 with regards to design practice. Our findings revealed that the interest in sustainability and sustainable design (Fuad-Luke, 2009) has not translated into frequent practice by designers in either developed (Aye, 2003; Kang et al, 2008; Kang & Guerin, 2009; Mate, 2006), or developing countries (Hankinson & Breytenbach, 2012). In order to gain a deeper insight into the reasons behind this, we studied existing scholarship on the barriers to sustainability design. The findings were thematically grouped into seven distinct meta-barriers to sustainability-design practice.

These can again be grouped into two categories (Fig. 4.3)—barriers which are linked to the organization, and barriers which are fundamental to the design process. The grouping revealed that designers need support from their organizations to address almost all of the barriers, except Barrier 1 (lack of knowledge about sustainability), and Barrier 6 (lack of tools), which arise due to knowledge and mechanism gaps in the design process itself.

NO.	BARRIER	ORGANIZATION LINKED	DESIGN-PROCESS LINKED
1	Lack of knowledge about sustainability		●
2	Lack of holistic overview on production-to-consumption systems and value chains	●	●
3	Failure to include sustainability at a strategic level in the overall approach	●	●
4	Failure to include sustainability in the design brief	●	●
5	Lack of a collaborative design process	●	●
6	Lack of tools		●
7	Failure to keep design team in the loop during product actualization	●	●

Figure 4.3: Grouping the seven barriers to sustainable design into organization-linked gaps and design-process-linked gaps (Reubens 2016)

Overall, our inquiry into Research Question 1 through this literature survey indicates that, while sustainability is growing in importance in the business landscape, and while designers are ideally positioned to leverage the opportunities this presents, the existing sustainability approaches and assessment systems available to designers do not address sustainability holistically. In addition, designers in both developed and developing countries do not frequently practice sustainable design. Further action on Research Question 2—centered on improving sustainability design approaches—could draw on the meta-barriers identified through this literature research, especially those intrinsic to the design process, namely, lack of knowledge about sustainability, and lack of tools.

The following chapter presents the literature review on design for the craft sector in the developing world, closing in on the issue at the heart of Research Question 1—sustainability design praxis for craft-based MSMEs in developing countries.

05 TO CRAFT, BY DESIGN, FOR SUSTAINABILITY

This chapter presents the final installment of the literature review, the three parts of which consecutively narrowed in to address Research Question 1—to what extent do designers address sustainability holistically while working with non-industrial, renewable materials and craft-based MSMEs in developing countries. It also begins to build the elements which come together to form the composite conceptual framework, which will be discussed in the following chapter.

The linkages between sustainability, development, design, and production-to-consumption systems, discussed in the two previous chapters, form the backdrop to this chapter. Chapter 4 explored the extent to which designers address sustainability holistically, thus partially addressing Research Question 1. This chapter homes in on the issue at the heart of Research Question 1—sustainability design for craft-based MSMEs in developing countries working with non-industrial, renewable materials.

Section 5.1 defines craft in order to put in place a reference point for our research. It then situates the context of the problem, by discussing the decline of flourishing craft production-to-consumption systems in the developing world due to the industrial and information revolutions. We also discuss the opportunities that the information revolution offers for sustainable development and sustainability in general, in aligning unsustainable craft production-to-consumption systems in the developing world with emerging sustainability markets.

The unsustainability of craft production-to-consumption systems in developing countries has tremendous resonance with the agendas of sustainability and sustainable development. We explore these commonalities between craft and the tenets of sustainability in 5.2.

The rationale for craft to take the innovation-led, value-added manufacturing path, aligned to sustainability markets, in order to contribute to sustainable development in developing countries, is discussed in 5.3. In the next section, we look at the designer's role in enabling craft to actualize this potential. We also explore existing craft–design interactions, especially those meant to create an impact on sustainability markets and sustainable development.

Finally, 5.5 offers the summary and main findings of the literature reviewed in this chapter. In addition, it answers Research Question 1 based on the literature reviewed in Chapters 3, 4, and 5.

5.1 THE BROAD PHASES OF CRAFT IN DEVELOPING COUNTRIES

Craft—like *design* and *sustainability*—is a highly contested, broad term, which evades a single, commonly accepted definition (Kouhia, 2012). Several themes—including products, handmade, minimal use of machinery and hand tools, substantial skill and expertise, element of tradition and livelihood (Liebl & Roy, 2000)—recur in literature that centers on craft. While each of these elements embodies *craft* singly and jointly, there is no consensus on these themes, or on their hierarchy in relation to *craft*. In order to anchor our research process, and based on the literature review, our research defines *craft* as a non-industrial production-to-consumption system that encompasses products (crafted objects), skills (craftsmanship), producers (craftspeople) (Rissati, 2007) and trades or occupations (craft) (Ihatsu, 2002). A brief account of the status of craft-based production-to-consumption systems in developing countries—from pre-industrial times to the present—is offered below.

PRE-INDUSTRIAL CRAFT: FLOURISHING

Craft was the common mode of manufacture in the pre-industrial world. Before industrialization, everything around the world was parochially (Hill, 1997) handcrafted by craftspeople using simple tools and minimal machinery. The direct linkage between craftspeople and buyers, and the scale of production, made it possible for craftspeople to internalize and perform multiple roles in the value chain, including innovation, marketing, entrepreneurship (Vencatachellum, 2006) and production. Craft production-to-consumption systems ranged from the *traditional* or *vernacular*—the collective cultural and utilitarian expressions of a rural community (Greenhalgh, 1997)—to the *fine* and *decorative* art commissioned by wealthy patrons including churches, temples (Heslop, 1997), political rulers such as royalty and courtiers, and wealthy men such as the leaders of guilds (Jaitley, 2001) and merchants. Most pre-industrial rural craft catered to the local market located within the city walls. In most instances, production surplus was only exported to distant markets on secondary priority (Diez, 2013). However, scholarship contains several instances of flourishing craft-industries in what is now the developing world—including India's textiles and China's porcelains—which centered on non-local markets. In these scenarios, craftspeople were federated through different mechanisms—including as members of artisan's guilds (Khan, n.d.) or through village-specific product specializations (Fanchette & Stedman, 2010)—in order to optimize production and trade.

POST-INDUSTRIAL CRAFT: DECLINE

The displacement of Europe's craft production-to-consumption systems by industrial ones brought increased employment, economic wealth and development to the continent. However, Europe's industrialization set the development processes back in its colonies, due to the decline of their flourishing craft production-to-consumption systems (Rothermund, 1992). Thriving craft-based export industries—such as India's handloom sector—were systematically sabotaged by colonial policies designed to reduce exports, while simultaneously leveraging the colonies as lucrative markets, which could absorb industrialized imports (Khan, n.d.). While this led to the decline of craft-based export industries, rural craft in the developing world survived because a lack of infrastructure and accessibility meant that industrialization could not penetrate into the villages (Rothermund, 1992). Industrial products were finally able to percolate down to these rural areas only when the developing countries embarked on their own development processes in the late 19th century.

In a bid to bolster their industrial potential, some developing countries, such as Vietnam, put in place policies to replace traditional systems of craft production and organization—such as guilds, and individual- and family-production units—with cooperatives (Fanchette & Stedman, 2010). The cooperative system led to a decline of robust craft industries, due to the isolation of craftspeople; the government became the mandatory intermediary for all production and distribution transactions related to the craft cooperative (Fanchette & Stedman, 2010). Craft in developing countries survived cooperativism and the growing trickle of industrial products by lowering product costs (Jaitley, 2005)—including by using imported low-cost industrial raw materials, tapping into a cheaper workforce comprising women and children, who could be exploited (Afacan, n.d.), and deskilling—thereby becoming an industry for the poor run by the poor (Roy, 1999).

POST-INFORMATION REVOLUTION CRAFT: NEED AND POTENTIAL FOR REVITALIZATION

The final blow to craft in developing countries was dealt by the information revolution, which facilitated the penetration of low-cost, high-volume industrialized goods into previously inaccessible markets and, more importantly, into the psyche of consumers. A substantial market segment for craft—including rural buyers—now have access to globalized media, and demand industrialized technology over traditional (Chaudhary, 2010) craft products. Over the last few decades, craftspeople in developing countries have found themselves disconnected from their consumers, unable to cater to distant markets and, therefore, with no takers for their products (Jaitley, 2001). Several crafts have vanished or are declining (Jaitley, 2001), and the available low-cost craft comes with hidden costs—including environmental degradation, unsafe and unhealthy working conditions, and unfair wages (Chotiratanapinun, 2013).

Figure 5.1 depicts the findings of the literature review on the existing market equations for both design- and craft-led production-to-consumption systems. The column on the left describes the pre-industrial craft production-to-consumption system, where the craftsperson used renewable materials and produced through craft techniques for traditional markets. The column on the right describes how, post-industrialization, the designer took over the bastion of innovation, designing products produced from industrial materials, using industrial means of production, for mainstream markets. Until the information revolution, the left column was still relevant in rural pockets where industrialization could not penetrate due to a lack of development. However, post-information revolution, these industrial products have also been able to penetrate traditional markets originally serviced by craftspeople, thereby reducing their share in traditional rural markets.

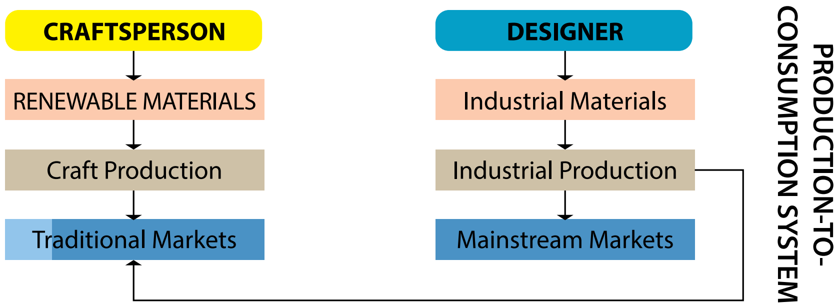

Figure 5.1: Production-to-consumption systems pre- and post-industrialization, and post-information revolution (Reubens 2015)

Parallel to this, the past 15 years have seen a surge of interest in craft (Ferris, 2009) from the developed world and urban areas in the developing world, as higher incomes among consumers in these segments allow them to look beyond meeting basic needs to purchasing differentiated handcrafted products with an ethnic identity (United Nations Development Organization, 2002). Both of these scenarios—the decline of rural craft markets and the growth of urban ones—indicate the need and potential to reposition the place, purpose and relevance of craft in post-industrial societies (Ferris, 2009). Recent academic discourse—through platforms such as the Making Futures Conferences (Plymouth College of Art, n.d.), the *Craft + Design Enquiry* journal (Craft+ Design Enquiry, n.d.), and the *Craft Research* journal (Intellect, n.d.)—touches upon the need to reposition craft more closely with contemporary economic, social, cultural and ecological needs, including sustainability concerns.

5.2 THE ANALOGOUS AGENDAS OF CRAFT, SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY

The unsustainability of traditional craft production-to-consumption systems in the developing world, and the simultaneous demand for recontextualized craft production-to-consumption systems globally—described in the previous section—encompass both the agendas and opportunities for sustainability and sustainable development (Chatterjee, 2014). These include social and environmental degradation, inclusive development, gender issues, globalization, localized livelihoods, urbanization and distress migration (Chatterjee, 2014). The UN's recent development agenda echoes these in its call for sustainable development with inclusive economic growth, decent employment, social justice and protection, and environmental stewardship, towards addressing global challenges with local solutions (Moon, 2014). Craft has the potential to do all of these, holistically (Chatterjee, 2014), and thus impact all four tenets of sustainability. The opportunities for synergy between craft in developing countries and the four tenets of sustainability, as defined by our research, are examined below.

ECOLOGICAL SUSTAINABILITY VIS-À-VIS CRAFT

Ecological sustainability rests on sustaining environmental or natural capital (Harte, 1995). Since traditional craft comprises a localized production-to-consumption system, it has a strong sense of local natural capital and stewardship. Traditional craft production-to-consumption systems have evolved over centuries with due consideration to the strengths and vulnerabilities (Gaur & Gaur, 2004) of their respective bioregions. Craftspeople, therefore, have a deep regard for their bioregional resources, which they recognize, value and use for medicine, food, craft (Salmon, 2000), and as a basis for innovation (Chatterjee, 2014).

Several traditional communities have embedded systems of custodianship and stewardship of the natural environment in their religious, social and cultural practices and worldviews; they hold kin-centric and animistic worldviews, where man and nature are an interrelated part of an extended ecological family (Salmon, 2000). Mechanisms such as totems and taboos create a ritual bond between humans and nature; totemic animals and/or plants are assigned to specific social groups who revere and protect those species. Each generation is entrusted with safeguarding ecological resources by ancestral sanction (Dovie et al, 2008; Gaur & Gaur, 2004). One of the community-specific mechanisms to sustain natural resources and, thus ensure sustenance of the ecological resource base, is the practice of *molong*—never take more than is necessary (Lloyd, 2008)—prevalent among Malaysia's Penan tribe. When the Penan *molong* a tree, they mark it with a cut, so that other harvesters are aware that it has already been tapped and needs time to regenerate.

Craftspeople are mindful of common-property natural resources—such as forests and rivers—to which they have traditionally had free access, because they depend on these for the sustenance of their craft. Since the ethos of resource conservation and optimization are deeply entrenched in the worldviews and practices of craftspeople, they harvest only what they require; ensuring the sustainability of the community's common stock of natural capital, and their craft and livelihoods as well.

Craftspeople—like most economically backward communities—create and suffer from ecological degradation (Anand & Sen, 2000). They are deeply affected by exogenous ecological degradation and the consequent scarcity of natural resources including flora, fauna, water, earth and non-renewable resources, which are input materials in their craft (Chatterjee, 2014). These damages, including through ecologically unsustainable craft production-to-consumption practices, can be monitored by the community as their craft is a localized activity. Globalized production-to-consumption systems lack such a feedback loop, making it difficult to monitor and regulate systemic instances of unsustainability, including resource depletion or degradation (Thorpe, 2007).

SOCIAL SUSTAINABILITY VIS-À-VIS CRAFT

Traditional socio-economic systems of exchange and subsistence linked craftspeople to the wider community, such that their productivity was not directed purely towards economic gain, but also addressed maintaining community life as a whole (Society for Rural, Urban, and Tribal Initiatives, 1995). Since these systems of social obligation were not based purely on monitory transactions, they afforded craftspeople security in times of scarcity (Society for Rural, Urban, and Tribal Initiatives, 1995), in line with the concept of social security.

The loss of livelihoods and the consequent breakdown of socio-economic systems have negatively affected the social sustainability indicators of craft producers, including their health, education, safety and human rights. Given their dwindling market and landlessness (Reubens, 2010a), craftspeople are forced to distress-migrate to cities, damaging their family and community nucleus. The livelihoods they are forced into—as laborers and, in some extreme cases, sex workers (Kodapully, n.d.)—indicate their deep social unsustainability and inequity. The revival of craft production-to-consumption systems would promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all—essentially, the Eighth UN Sustainable Development Goal. This, in turn, would allow these communities to actualize the remaining Goals, including those focusing on the social mandates of health, education, food security, inclusiveness and shelter.

Craft capital is a resource that marginalized communities—such as ethnic minorities—can leverage towards economic and, thereby, social benefit (United Nations Development Organization, 2002). If this is done through a community-based organization, it simultaneously strengthens a community's cohesiveness, which further empowers its members to negotiate issues of social inclusion (United Nations Development Organization, 2002).

Addressing the female workforce—often invisible in craft production—is a means to address the issues of gender equality and women's empowerment (Chatterjee, 2014). Despite being exploited, women continue to work in craft production, because it offers them flexibility in terms of work location and schedule. Reorganizing these women into contemporary and equitable craft-federation formats—such as fair-trade self-help groups—recognizes their economic contribution; unlike traditional gender-specific task division (Veillard, 2014). This, in turn, empowers women (Guadalupe, 2012); affecting their practical needs—including well-being, income, and ownership of assets—and also their strategic needs—including better access to the means of production and benefits—alongside the ability to renegotiate power relationships (Moser, 1989).

ECONOMIC SUSTAINABILITY VIS-À-VIS CRAFT

Craft-based enterprises employ a large part of the workforce in developing countries (Hallberg, 1999), and are a source of livelihood, second only to agriculture (Chatterjee, 2014). Their sheer numbers establish craft's relevance to economic development. Craft-based enterprises are intrinsically labor-intensive (Hallberg, 1999), and therefore integral to the socio-economic fabric of developing countries due to the employment they provide. Revitalizing these enterprises offers opportunities for socio-economic sustainability to a large number of people, through the themes of livelihoods, higher standards of living, social stability, value-added sectors, and a domestic market (United Nations Development Organization, 2002). Craft enterprises contribute to a more equitable distribution of income, given that most of their owners and workers fall in the lower half of the income-distribution spectrum (Hallberg, 1999).

Most craft practice in developing countries falls under the category of MSMEs. Literature indicates that SMEs are more efficient than both larger and smaller firms; because their flexibility allows them to better respond to dynamic demands (Hallberg, 1999), while simultaneously maintaining quality (Snodgrass & Biggs, 1996). An economy which includes a substantial number of SMEs—including craft-based MSMEs—therefore allows for more economic flexibility, growth potential and employment opportunities (United Nations Development Organization, 2013). This positions craft-based MSMEs to be a potential part of the emerging private sector in developing countries (Hallberg, 1999). It also allows them to become vehicles for holistically sustainable and inclusive expansion of productive capacity, and value-addition through development (Yong, 2013).

Craft-based production-to-consumption systems are traditionally localized. This dovetails with the concepts of community-based economics and regional trade, which are perhaps the truest models of localized economic security. Essentially, this means a community is largely self-reliant in terms of producing what it needs to survive. Economic sustainability and growth become endogenous when most of the economic and human resources are local (Moreno et al, 2005), and the entire production-to-consumption system is locally anchored as well.

CULTURAL SUSTAINABILITY VIS-À-VIS CRAFT

Craft consists of a body of cultural capital which is passed down from generation to generation (Ihatsu, 2002). The transmission mechanisms of craft—including the oral traditions and expressions, social practices, and indigenous knowledge—translate into intangible cultural heritage (Moreno et al, 2005) and capital. Figure 5.2 outlines the cultural capital repositoried in indigenous knowledge, which can be leveraged for product differentiation, resulting in knowledge-based products and services with cultural relevance (United Nations Development Organization, 2002)—the creative industries. Incidentally, the craft sector is among the 13 economic sectors which fall under the banner of *creative industries*. Craft's cultural capital—including craftspeople—is an enduring resource of the developing world (United Nations Educational, Scientific, and Cultural Organization, 2005), and has received international attention from diverse platforms, because it can constitute the basis for differentiated employment and income (United Nations Development Organization, 2002).

Thailand is an example of a country whose craft sector has successfully aligned with the creative economy. Thailand's *One Tambon, One Product (OTOP)* initiative, focuses on knowledge and creativity-based production in order to deal with the rural economic crisis, and the replacement of Thai craft exports with lower-cost substitutes from other countries. One of OTOP's main strategies is the use of indigenous knowledge and *Thai-ness* to add value to and differentiate their products; the concept is further reinforced through branding and marketing strategies (Chotiratanapinun, 2013).

SR. NO.	TYPE OF INDIGENOUS KNOWLEDGE	EXAMPLES
1	Information	Trees and plants that grow well together, indicator plants, flora-fauna and seasonal patterns
2	Practices and technologies	Seed treatment and storage, medicines, nature-based processing technologies, craft-technologies
3	Beliefs	Stewardship of natural resources and resource allocation, and sharing vested in belief systems
4	Tools	Tools and implements including utilitarian craft products for agriculture and subsistence
5	Materials	Bioregional input materials for construction and craft
6	Experimentation	Trial and error towards improved knowledge of bioregional resources
7	Biological resources	Indigenous flora and fauna
8	Human resources	Socio-economic systems of labor, exchange and specialization
9	Education and knowledge-transfer mechanisms	Oral traditions, apprenticeship
10	Communication	Folk media, rituals

Figure 5.2: Types of indigenous knowledge adapted from Rao, 2006 (Reubens 2014)

Indigenous belief systems held by traditional craft communities—such as the Indian concept of *vasudhaiva kutumbakam,* i.e., the Earth family (Shiva, 2005)—resonate with the ethos of sustainability. Countries and societies that support and promote craft-based industries inherently create a cultural shift towards sustainability—something that is increasingly being recognized as a key driver for future development, given non-negotiable issues including resource constraints (United Nations Development Organization, 2013).

5.3 NEED AND POTENTIAL FOR CRAFT TO TAKE THE INNOVATION-LED, VALUE-ADDED MANUFACTURING ROUTE, ALIGNED TO SUSTAINABILITY MARKETS

This section discusses why craft should take the innovation-led, value-added manufacturing route, aligned to sustainability markets.

EMERGING MARKETS ALIGNED TO SUSTAINABILITY

Craft is poised to address new markets that are aligned to sustainability because, as discussed above, many overarching concepts of sustainability—such as environmental responsibility, social justice, cultural diversity and economic inclusion (Borges, 2013)—underpin craft practice (Rees, 1997). These sustainability-aligned markets are expanding faster than markets for conventional products. Increasingly, these markets are looking beyond ecological considerations, to include a wider spectrum of sustainability criteria (Potts et al, 2010). Mainstream markets also display a huge trend towards mass-produced designer goods which embody handmade qualities—such as uniqueness (Na, 2011), imperfections, authenticity, familiarity and nostalgia—generally associated with craft (Greenlees, 2013).

THE INFORMATION REVOLUTION'S KNOWLEDGE CLASS

The tacit and indigenous knowledge and sustainable systems that underpin craft (Fig. 5.1) can be the basis for innovative value-added products crafted by communities (Ihatsu, 2002), aligned to the promising sustainability markets (Craft Revival Trust, 2006) discussed above. Capitalizing on craft's tacit knowledge would enable craftspeople to dovetail with the growing *knowledge class* (Humbert, 2007) of the information revolution, which replaces capital and labor—the key factors of production of the industrial revolution—with knowledge and information (Humbert, 2007). This creates a new paradigm for development which links the economy and culture; and acknowledges the potential of knowledge, creativity and access to information as engines for economic growth and development in a world which is rapidly globalizing (United Nations Conference on Trade and Development, 2008). If craft's indigenous knowledge is not recognized or leveraged, the perilous situation of craftspeople will grow even more untenable, due to their lack of formal education and formalized knowledge (Bhaduri, 2016).

The production-to-consumption systems of products that are underpinned by craft's tacit knowledge offer an opportunity to contribute to sustainable development by repositioning craft as a repository of knowledge, techniques and philosophy that can be an approach to community development (Akubue, 2000). This is also in line with the concept of *creative industries*, which have the potential to create wealth and generate income by leveraging cultural capital towards knowledge-based goods and services (United Nations Educational, Scientific, and Cultural Organization, 2005).

REALIZING THE POSSIBILITY TO BYPASS THE UNSUSTAINABILITY OF THE MAINSTREAM DEVELOPMENT PARADIGM THROUGH CRAFT

Leveraging craft's tacit knowledge capital towards value-added manufacturing can help developing countries to bypass the unsustainability of the traditional industrialization paradigm. The generic industrialization paradigm first focuses on manufacturing, then on making manufacturing more efficient through capital-intensive technology, and—finally—on going beyond process-innovation to product-innovation (United Nations Industrial Development Organization, 2013). At this advanced stage, it is recommended that countries aim for differentiation. This is done by improving quality and through innovations in products and services—including in upcoming areas such as green technology and sustainability, which are increasingly becoming important drivers for structural change in development (United Nations Industrial Development Organization, 2013). Generally, when the technology of the second phase and innovation of the third phase align, manufacturing becomes innovative and value-added, while simultaneously remaining efficient by maintaining reduced labor and increased capital (United Nations Industrial Development Organization, 2013).

Jumping ahead to the last phase of the development paradigm described above—while simultaneously maintaining labor-intensiveness of the first phase—would help developing countries to industrialize in a manner that addresses challenges of poverty and unemployment (United Nations Economic and Social Council Economic Commission for Africa, 2013). Craft is ideally positioned to actualize this possibility of innovation-led, value-added manufacturing, with large-scale employment opportunities, because it is intrinsically knowledge-based, labor-intensive and manufacturing-related. Moreover, it inherently aligns with sustainability; a strong prospect for differentiation in the third phase.

The possibility of innovation-led, value-added manufacturing is not only a potentiality, but also a need for craft. Craft urgently needs to strategize in order to survive, because the rise in employment in the informal-sector in developing countries (United Nations Industrial Development Organization, 2013)—including in craft MSMEs—cannot be sustained once the economic development from manufacturing raises labor costs (United Nations Economic and Social Council Economic Commission for Africa, 2013). This makes it imperative for these enterprises to look beyond low labor costs to value-addition, through increased skill, innovation (United Nations Economic and Social Council Economic Commission for Africa, 2013) and differentiation, if they are to survive in the long run. Value-added products will also help craft-based enterprises to compete with the globalized high-quality, low-cost imports (United Nations Economic and Social Council Economic Commission for Africa, 2013) that are flooding their traditionally closed economies. As discussed earlier, the inability to compete with globalized substitutes is one of the key reasons why craft has languished in developing countries (Borges, 2013)—despite encompassing local, national and international production-to-consumption systems, and spanning the spectrum from utilitarian to luxury goods (Jaitley, 2001).

5.4 ROLE OF DESIGN IN ACTUALIZING CRAFT'S POTENTIAL TO BE A VEHICLE FOR SUSTAINABLE DEVELOPMENT

The information revolution creates both a push and a pull for craft to leverage emerging sustainability-aligned market opportunities. However, as discussed in the earlier chapters, craftspeople are unable to access these lucrative markets for sustainable products (Potts et al, 2010), because of the information gap. "While the 'know-how' (how to make things—knowledge and skills) exists abundantly in the crafts sector, there is a severe shortfall in the 'know-what' (what to make—strategies and designs) that curtails the ability of crafts communities to survive intense competition or, better still, develop value-added solutions in a complex economic and social matrix in which they exist" (Panchal & Ranjan, 1993, p. 14). A synergistic collaboration between craft and design that centers on innovation, responding to contemporary needs and sustainability issues seems to offer a way forward (Fig. 5.3) (Greenlees, 2013).

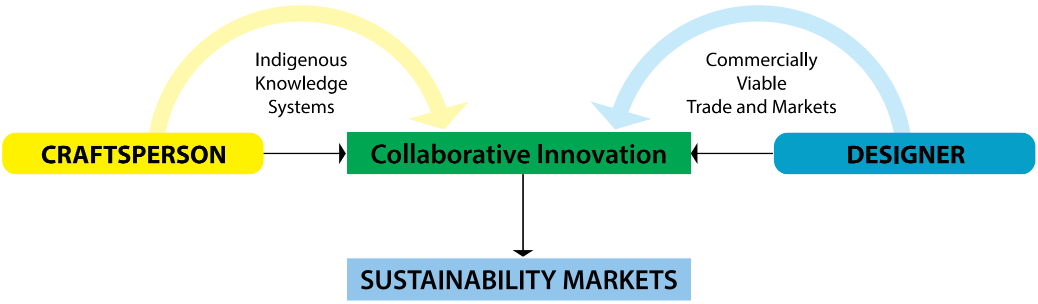

Figure 5.3: Craft–design collaboration to target sustainability markets (Reubens 2015)

Most of the sustainability-centered craft–design interactions documented in literature are initiated by international development agencies, NGOs and governments, who interface with community-based organizations (Rhodes, 2011). These interactions are intended to widen the reach of products crafted by communities (Borges, 2013), and to also serve as a vehicle to achieve sustainability agendas—particularly the social-development themes of economic empowerment, poverty alleviation and livelihood generation. The common modus operandi for most craft–design interactions is through *design intervention*, in which craft communities feature as a skilled—and often low-cost—workforce, which produces designs developed by a professionally trained designer (Borges, 2013; Frater, 2009; Kodapully, n.d.). The resulting products are positioned as being inspired by local culture.

The aim of several of these projects is to link languishing traditional crafts to wealthier markets in the West, through design assistance (Murray, 2010). The ubiquity of this model is evidenced in the several transnational examples of designers leveraging developing-country craft, to create products with a *Western* aesthetic (Chotiratanpinun, 2013). These products are projected as bridging the global north/south by combining *northern* design expertise with *southern* craft traditions (Murray, 2010).

Several projects that follow the model described above have indeed widened the reach of community-crafted products, and may be construed to be fair—if all the concerned parties are clear on the nature of the transaction and agreeable to the terms of payment (Borges, 2013). However, these projects have not been so successful in addressing the theme of social development, and cannot actually be deemed social-design projects, because they lack an equal exchange, continuity and respect for the local culture (Borges, 2013). Several craft–design projects, which are positioned as *aid to artisans*, in reality, facilitate dependency relationships, rather than contributing to their eradication (Bonsiepe, 2011; de Waal, 2002; Lyon, 2006; Scrase, 2003). One of the reasons for this is that the design paradigm—due to its deep connection with industrialization—overlooks craft, and thereby craftspeople, craft culture and craft knowledge systems (Kodapully, n.d.). Even though the ultimate beneficiary of several of these projects is meant to be the craftsperson and not the private sector (Murray, 2010), the limitation of perception and perspective affects designers' ability to facilitate livelihood solutions for craftspeople (Kodapully, n.d.).

The insufficient internalization of the craft scenario—including technique and context—can also lead designers to inadvertently intensify the problem of craftspeoples' livelihoods. Borges (2013) narrates an example of such a situation in Paraguay, where potters were provided with loans to purchase kilns that were intended to improve the quality of their pottery. However, the new ovens changed the firing process, and thus the color of the final product—something the designers had not anticipated. The eventual designs in the new color were not well-received by markets, leaving craftspeople with no new income from the product line, while simultaneously struggling to pay off the loans.

Sometimes, the unintended adverse effects of design interventions run deeper than a missed market opportunity; they extend to the erosion of the communities' cultural capital and well-being. Design interventions which fail to capitalize on the indigenous knowledge contained in craft do not actualize their potential to align with sustainability markets. Worse, such approaches may dilute and diffuse the communities' cultural capital—thereby jeopardizing the very resource that can provide the basis and direction for differentiation, which can help these craft products find their place in a globalized world (Frater, 2009).

Our review of craft–design interactions in the developing world revealed several examples of top–down designer-led approaches, which failed to contribute to social sustainability, or impact the socio-economic status of craft communities (Frater, 2009). Some of these interactions were criticized for their negative impact—eroding the cultural capital of communities (Frater, 2009). The ecological dimension has not been addressed in any of the interactions.

While literature contains several examples of top–down designer-led approaches which fail to contribute to the sustainability of craft-communities in terms of their income or social status (Frater, 2009), it also contains some heartening examples that showcase the benefits of collaboration in craft–design interactions. Rhodes' (2011) research describes how Western makers worked in collaboration with craft communities in Africa, translating craft capital into activities that generated eco-income. Murray (2010) describes Martina Dempf's co-creation of grass-based jewelry with Rwandan women. Following the project, both Dempf and the women created their own version of the designs, reflecting equity in opportunity and creativity. Marchand (2011)—over the course of his research with Yemeni minaret builders—developed an approach to leverage social knowledge towards social innovation solutions, which are facilitated, but not dictated by designers and development institutions.

Benchmarks of craft–design synergies include the Italian model, where sophisticated design and fine craftsmanship have been used synchronously as a mode of economic and cultural development (Secondo, 2002). In a similar vein, several countries—including Japan, Taiwan, South Korea, Switzerland, Germany and Italy, and Scandinavia in general—attribute their success in design and manufacturing to their craft legacy (Chaterjee, 2014).

Also encouraging is the emerging action research and scholarship which looks at positioning craft as a methodological framework (Ferris, 2009), through which to impact and leverage social, economic, cultural and economic sustainability (Borges, 2013). This could provide the basis for an alternative craft–design paradigm, the main challenge of which would be the same as that facing social innovation and design projects—namely, avoiding the highly criticized path of imposing top–down solutions on local communities, by engaging the community in the innovation process; and recognizing the communities values, priorities and character (Greenlees, 2013).

5.5 SUMMARY AND CONCLUSION

Craft has a huge potential to contribute to sustainable development in developing countries. It is labor-intensive, it comprises a substantial part of the economic fabric of developing countries, and it has the potential to dovetail with the information revolution's knowledge and creative economy to access new and lucrative sustainability-aligned markets. For these reasons, it provides developing countries with the opportunity to side-step the generic development paradigm, provided it can dovetail with the innovation-led, value-added and manufacturing-oriented paradigm.

Design has an important role in actualizing craft's potential to align with the innovation-led, value-added and manufacturing-oriented paradigm through craft–design collaborations. Countries such as Japan, Taiwan, South Korea, Switzerland, Germany, Italy, and the Scandinavian nations in general, attribute their design and manufacturing achievements to their craft legacy (Chatterjee, 2014). However, our review of craft–design interactions in the developing world revealed that most of these were top–down and designer-led and did not address sustainability holistically. Several of these interactions had failed to contribute to social sustainability or significantly raise the socio-economic status of craft-communities (Frater, 2009), and some of these had been criticized for eroding the cultural capital of communities (Frater, 2009). The ecological dimension has not been addressed in any of the interactions.

These findings, along with the findings from the previous chapter on sustainability-design approaches, and assessment systems and practice, indicate the answer to Research Question 1: design does not currently address sustainability holistically—considering simultaneously all of its dimensions including social, economic, ecological and cultural dimensions—while working with non-industrial craft-based MSMEs in developing countries working with renewable materials. Existing sustainability-design praxis in general focuses on ecological and economic dimensions, though it appears to be including social aspects in its scope. In the case of craft-based MSMEs, the design focus and impact seems to be primarily the economic dimension. Although social and cultural priorities are cited, the extent to which they have been achieved and the means of achieving them are questionable. The existing design praxis we studied did not contain examples where design, craft and sustainability have been successfully harnessed together for holistic sustainability.

Emerging scholarship and discourse is beginning to recognize design's potential and intention to position craft as a methodological framework (Ferris, 2009), through which to impact and leverage social, economic, cultural and economic sustainability (Borges, 2013). However, this potential is yet to be realized and the proposed means to realize this are few and far between. Currently, craftspeople are very vulnerable in craft–design exchanges. Craftspeople depend on external middlemen for a range of functions—including accessing market information, design and technology inputs, finance and distribution. Whether these functions exploit or support craftspeople depends on their capacity to negotiate (Borges, 2013). This is why the collaboration-centered craft–design processes need to acknowledge and maximize the skill and knowledge that design and the craftsperson bring to the innovation process. Designers bring information about modern markets (broad blue arrow in Fig. 5.3), thus helping craftspeople cope with the process and consequences of industrialization (Craft Revival Trust, 2006). Craftspeople bring indigenous knowledge (broad yellow arrow in Fig. 5.3), which offers a window into the systems of integrated and holistic sustainability that underpins craft. In contrast to industrial design, which is driven by industry (Rees, 1997), craft is driven by the integration of tacit knowledge, innovation, skill, bioregional knowledge (Ihatsu, 2002) and traditional practices—which are all links into a single system determined by the interconnectedness between people, land, materials and energy (Ihatsu, 2002; Lea, 1984; Naylor, 1980).

The premise that craft capital can potentially be leveraged towards tapping sustainability markets and thus influencing sustainable development; and the wisdom of craft–design collaborations as a way to actualize this potential seems well-founded. However, the paucity of models which have realized these potential points to the urgent need for mechanisms which can actualize craft's potential for value-added manufacturing, within the context of sustainability and sustainable development (Greenlees, 2013).

Simultaneously, there is also a need for tools to help validate existing and future craft–design paradigms (Murray, 2010). Both of these needs resonate with Research Question 2: What can be a possible sustainability-design approach that would a) be mindful of the pros and cons of preexisting sustainability-design approaches, and b) address a holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries? Therefore, the following chapters will focus on iteratively developing such tools through a design science research process. These tools will be developed based on the findings of the literature review, and conclusions drawn thereon, all of which will be figuratively represented and discussed in the forthcoming chapter, which presents the conceptual framework which underpins this research.


AMESH

06 CONCEPTUAL FRAMEWORK

The previous three chapters comprised the literature review, which centered on Research Question 1 (To what extent does design address sustainability holistically—simultaneously considering all of its dimensions including social, economic, ecological and cultural dimensions—while working with non-industrial craft-based MSMEs in developing countries working with renewable materials?). We already began working on an analysis in Chapter 5 towards constructing the conceptual framework. The literature review revealed that designers do not address sustainability holistically. Most design which positions itself as aiming to impact sustainability is eco-centric, and reflects priorities and concerns of the developed world. The literature review also indicated that—while both craft and design can synergistically inform and support each other towards tapping sustainability markets, thereby affecting sustainable development holistically—most current craft–design engagements in the domain of non-industrial, renewable material and craft-based MSMEs in developing countries have not realized this potential. This suggests, and literature confirms, that there is a paucity of mechanisms to actualize meaningful craft–design engagements that aim to create and maintain sustainable development and sustainability in general.

The potential of craft–design engagements, vis-à-vis sustainability and the paucity of mechanisms to actualize this potential, indicate a design opportunity which dovetails with Research Question 2: What could be a possible sustainability-design approach that is: a) mindful of the pros and cons of the existing sustainability design approaches, and b) which looks at addressing a holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries?

In order to begin to address this question, we plotted the findings of the literature review through a conceptual framework described in this chapter. The understanding, working definitions and sentential representations, which emerged through the literature review in Chapters 2, 3 and 4, provide a basis for the conceptual framework—constructed in 5.1—which will inform and guide our research. The conceptual framework will underpin and inform our design science research in totality, including the iterative development of an approach in answer to Research Question 2.

We offer three versions of the conceptual framework in this chapter, each of which serves different purposes. The first provides a detailed pictorial depiction; the second supplements this by numbering key areas, and elaborating on these numbers through a textual narrative. Finally, the third version focuses on providing a concise pictorial overview of the focus of our design science research—improving sustainability design approaches (Research Question 2).

6.1 CONCEPTUAL FRAMEWORK

A conceptual framework is "a network, or 'a plane,' of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena (Jabareen, 2009, p. 51)." The conceptual framework for this research outlines the key elements, variables and constructs and the presumed relationships between them (Miles & Huberman, 1994) thereby offering a bird's-eye view of the study—including the concepts, assumptions, beliefs, theories and expectations that underpin and inform our research (Miles & Huberman, 1994; Robson, 2011). Each conceptual framework has implicit ontological, epistemological and methodological assumptions (Jabareen, 2009). Accordingly, the conceptual framework presented in Fig. 6.1 provides a basis and direction for the development of methods and tools to address Research Question 2—a possible sustainability-design approach for craft MSMEs in developing countries.

CONCEPTUAL FRAMEWORK VERSION 1: THE FINDINGS FROM LITERATURE

The first version of the diagrammatic conceptual framework presents the findings of the literature review (Fig. 6.1), which includes existing scholarship and theory, the research questions—including key concepts and elements of research direction. It aims to provide conceptual coherence to the research—by visually superimposing the findings of the literature review, especially the diagrammatic representations contained in Chapters 3 (Fig. 3.2), 4 (Fig. 4.2), and 5 (Fig. 5.2). The depiction of sustainability concerns and priorities of both the developed and the developing worlds are discussed in Chapter 3. The current and proposed design focus for design that aims to impact sustainability is discussed in Chapter 4. The craftsperson-led craft and designer-led industrial production-to-consumption systems are discussed in Chapter 5.

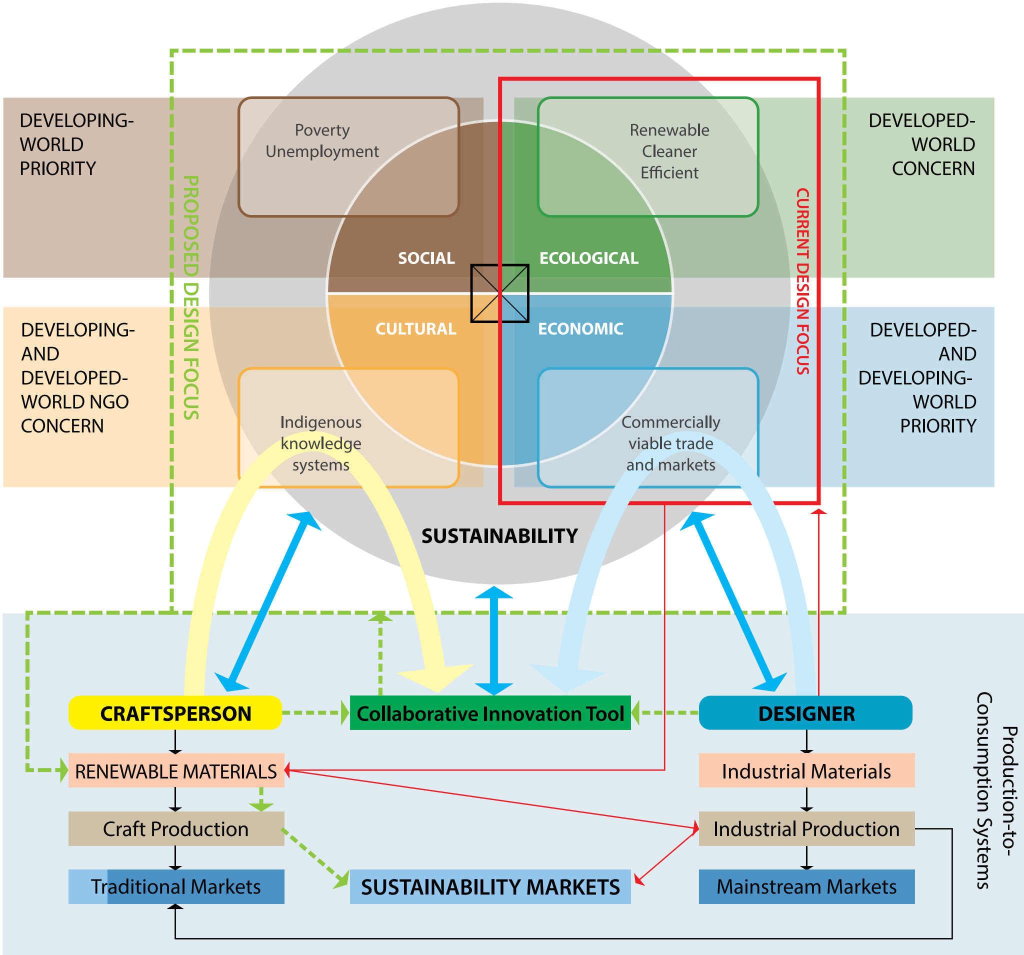

Figure 6.1: Conceptual Framework Version 1, depicting findings of literature review (Reubens 2015)

Fig. 6.2 offers Version 1 of a narrative explanation of the framework depicted above. Each of the numbers in the diagram corresponds to the points of the narrative.

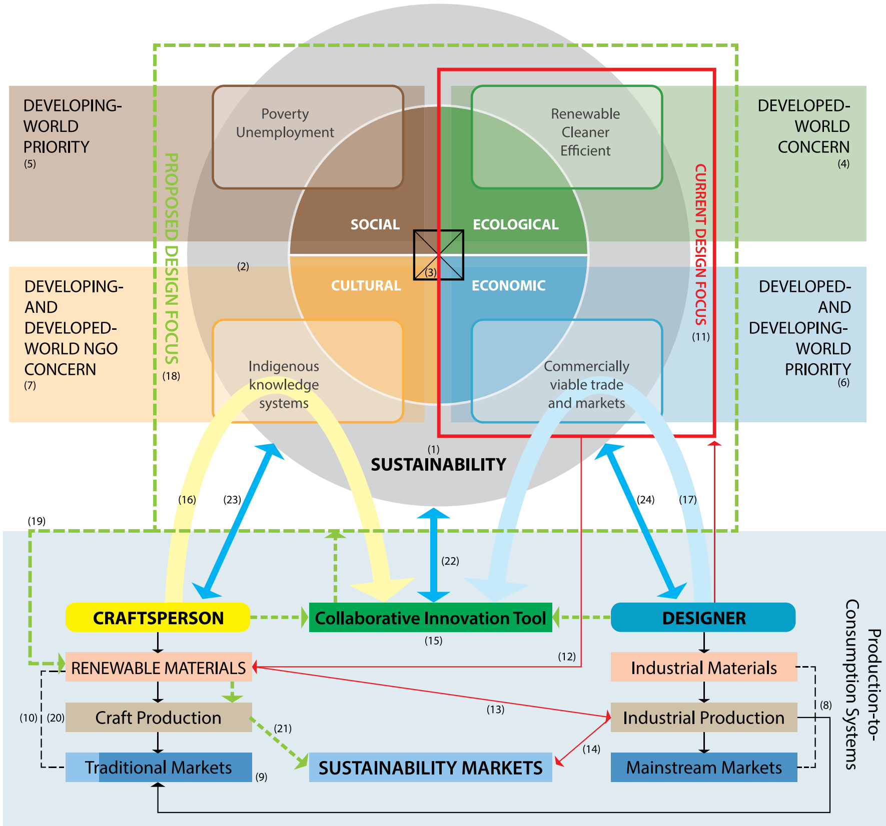

Figure 6.2: Narrative of Conceptual Framework Version 1 (Reubens 2015)

1. Sustainability is depicted on top of production-to-consumption systems, representing the fact that sustainability rests on production-to-consumption systems.

2. The diagram also depicts the four tenets—ecological, economic, cultural and social—outlined in our construct of holistic sustainability.

3. In order to convey that the tenets of sustainability—though depicted separately for visual coherence in Fig. 6.2—are interlinked and inseparable, we have circumscribed a square with diagonals within the sustainability circle.

4. The developed world is concerned with the ecological aspect of sustainability, which it proposes everyone address urgently—including through the use of renewable materials, and cleaner and more efficient production-to-consumption systems.

5. The developing world prioritizes socio-economic issues, such as poverty and unemployment, over ecological issues.

6. Economic development takes precedence in both the developed and developing worlds.

7. The issue of cultural sustainability has only recently been highlighted by not-for-profit organizations, development-sector institutions and scholars. However, it has received comparatively less attention than the other tenets, in the agendas of both developed and developing countries.

BLACK LINES AND ARROWS: *The black lines and arrows in the bottom half of the conceptual framework represent existing production-to-consumption chains.*

8. A generic industrial production-to-consumption system includes design by a designer, and the industrial processing of industrial materials, the output of which is sold in mainstream markets.

9. Industrial products have penetrated and captured a substantial share of the traditional market segment—as indicated by the darker color in the traditional-markets box; simultaneously, the market share of craft products in traditional markets is shrinking—as depicted by the lighter color.

10. A generic craft production-to-consumption system includes design by a craftsperson, the use of renewable materials (in most cases), which are crafted—generally in a labor-intensive manner; the resulting products are sold in traditional markets.

RED LINES AND ARROWS: *The red lines and arrows in the conceptual framework represent existing scenarios, and causal production-to-consumption chains orchestrated by design efforts towards facilitating sustainability.*

11. Current design efforts towards sustainability focus predominantly on the ecological and economic aspects of sustainability.

12. Sustainable design efforts include leveraging renewable materials that are traditionally used in non-industrial value chains.

13. These renewable materials are industrially processed.

14. Finally, they are pushed into emerging markets for sustainable products and systems.

GREEN LINES AND ARROWS: *The green lines and arrows in the conceptual framework represent our expected and proposed scenarios and causal chains, orchestrated by design efforts towards sustainability.*

15. Our research proposes a collaborative innovation which will leverage both design and craft expertise.

16. The craftsperson will bring expertise on the indigenous knowledge systems repositoried in craft to the collaboration.

17. The designer will bring expertise on commercially viable markets and trade to the collaboration.

18. The joint inputs of the craftsperson and the designer will lead to collaborative innovation, whose focus will be on a holistic picture of sustainability—including its ecological, economic, cultural and social aspects.

19. This research proposes to use renewable materials, traditionally used in non-industrial value chains, for these collaborations.

20. MSMEs will process these renewable materials in labor-intensive craft set-ups.

21. Finally, the holistically sustainable products will be marketed in emerging segments which demand and desire sustainable products and systems.

BROAD BLUE ARROWS: *The broad blue arrows in the conceptual framework represent the expected outcome of our research vis-à-vis holistic sustainability.*

22. The collaborative innovation tool will holistically impact all of the dimensions of sustainability, and will be informed by all of sustainability's dimensions.

23. Craftspeople will be better equipped to sustain their livelihoods and lives, and will thereby be better positioned to affect sustainability positively; as discussed in the literature review, the poor are both victims and agents of unsustainability.

24. Designers will be better equipped to address sustainability holistically; their designs will be better informed by a holistic picture of sustainability.

CONCEPTUAL FRAMEWORK VERSION 2: PROPOSED EMPIRICAL RESEARCH

The second version of the conceptual framework (Fig. 6.3) focuses on the proposed empirical research—including theories, directions and outcomes of our research. We offer this version in order to provide a clear and concise overview of the expected design science research and its impact (as depicted by the green dotted lines).

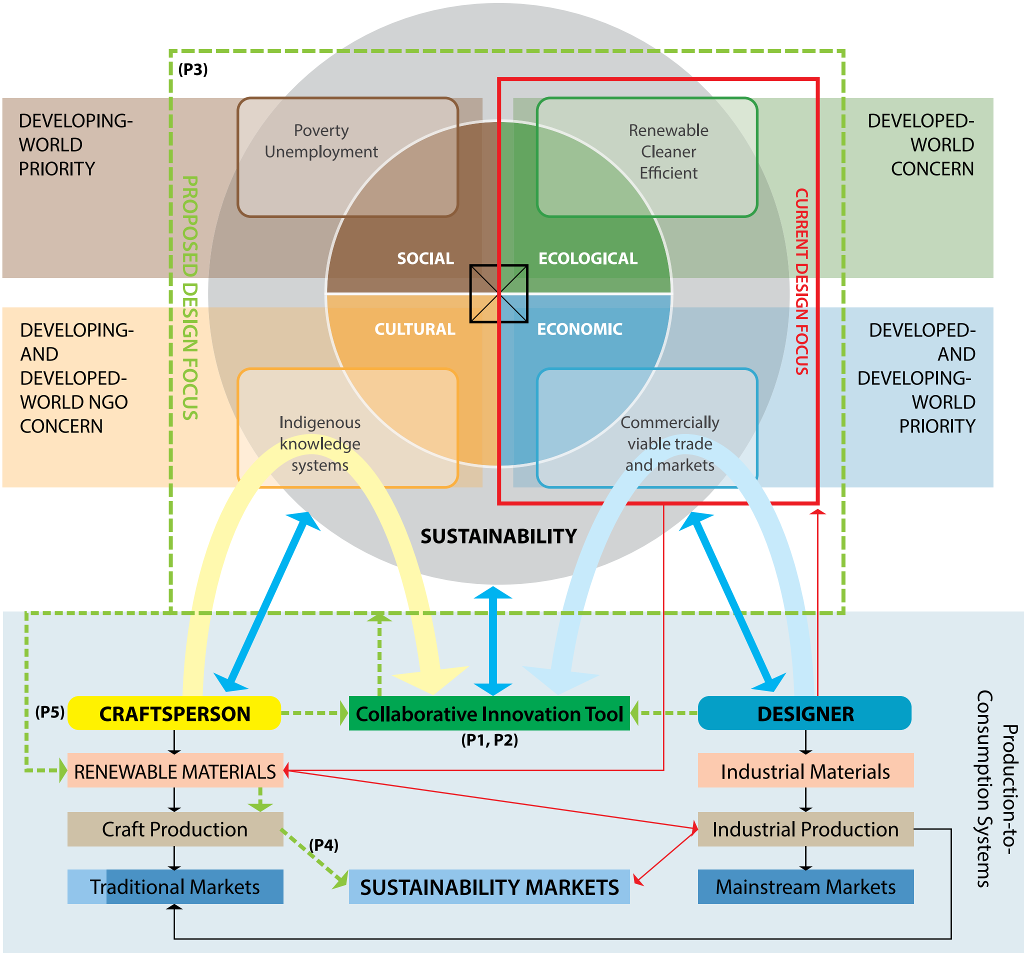

Figure 6.3: Conceptual Framework Version 2, depicting proposed design science research focus (Reubens 2015)

It is expected that the proposed empirical research will:

Proposition 1: Provide direction to the means and ends to actualize design–craft collaboration, thus facilitating the development of holistically sustainable products and production-to-consumption systems
Proposition 2: Provide a methodology towards collaborative innovation
Proposition 3: Provide designers with knowledge on sustainable design and clarify the impact of design decisions on sustainability in a holistic manner
Proposition 4: Allow for the assessment of how holistically the design achieves sustainability, including at the front-end innovation stage
Proposition 5: Will be a driver for sustainability design and marketing; and for sustainable production-to-consumption systems to remain on the track to sustainability

6.2 SUMMARY AND CONCLUSION

We constructed the conceptual framework in order to illustrate the different components of our research—including existing and tentatively proposed actors, causal chains and directions. Most of the literature reviewed focused on one or a few of the components which comprise the conceptual framework. Juxtaposing these components created a system which illustrated the complexity of the sustainability-design scenario—especially vis-à-vis craft-based MSMEs in developing countries. Five propositions were articulated to serve as objectives of solution or program of demands for the entire research and its outputs.

The literature review did not uncover a clear or successful approach or method for design to address this scenario. Therefore, our research proposes to develop and test such an approach—thereby answering Research Question 2—as part of the empirical research. The design of this empirical research (discussed in Chapter 2) was informed by the conceptual framework presented in this chapter.

This empirical research is conducted through a design science research process, which commences in the following chapter and centers on the Kotwalia tribe, which was selected to represent the client class for this research domain.

07 THE KOTWALIA COMMUNITY

The conceptual framework detailed in the previous chapter provides a background and point of departure for answering Research Question 2: What could be a possible sustainability-design approach that is: a) mindful of the pros and cons of the existing sustainability design approaches, and b) which looks at addressing a holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries? Since the literature review centered on Research Question 1, and did not uncover an existing approach which did this clearly or successfully, we propose to develop such an approach empirically, through an iterative design science research process.

As discussed in Chapter 2, design science research aims to address a specific problem class and, therefore, all individuals or institutions that fall within the generalized problem class are potential clients (Venable, 2009). While the potential client class for our research includes all non-industrial craft-based MSMEs that work with renewable materials in developing countries, we selected a real-context test group—the Kotwalia community—on which to focus the first phase of empirical research. This test group would represent the overall client class, and design outputs would be demonstrated and tested in their context. Findings from this test group could be generalizable to the overall client class. We have elaborated upon the reasons for selecting the Kotwalia community as the representative test group in Chapter 2 (2.3).

This chapter centers on providing an overview of the community in order to shed light on the layered complexities of craft production-to-consumption systems of non-industrial craft-based MSMEs in developing countries that work with renewable materials. An overview of the community—including, at a macro level, their socio economic and cultural situation and, at a micro level, their technology and its outputs—is offered in 7.1. An overview of the Kotwalia value chain is presented in 7.2, while the next section, 7.3, offers a window into their craft practice.

This chapter is composed of excerpts from our 2010 diagnostic study report, undertaken for the development of the bamboo craft cluster at Vyara, Songadh, Utchal and Valod blocks of Tapi district, under the participatory Cluster Development Programme of the National Bank for Agriculture and Rural Development (NABARD) (Reubens, 2010c). The NABARD report was compiled based on information collected during our visit to Kotwalia clusters in South Gujarat, in January 2010. The aim of the visit was two-fold: a) to validate the background material available on the Kotwalia community, and, b) to study and document, first-hand, various aspects of the production-to-consumption system which were not recorded in literature. An important piece of background literature included a socio-economic survey of 450 Kotwalia families conducted in 2008 by the Eklavya Foundation (Mehta, 2009). This was validated and supplemented by a survey on the craft skills of 250 Kotwalia families in 2009, which we designed and the Eklavya foundation executed. Data for both surveys was collected by administering a structured questionnaire to randomly selected Kotwalia families.

During our visit, the findings of the two surveys were validated through personal observation and photographic documentation. In addition, various aspects of the production-to-consumption system—including the product range, skills, tools and techniques, and marketing methods—were studied by interacting with the craftspeople. The information collected was collated and compiled into the aforementioned report for NABARD (Reubens, 2010c), which forms the basis for this chapter. The report dovetails with our design science research's endeavor to document and disseminate relevant aspects of the research process through publications.

The summary of this chapter, and conclusions thereon, are offered in 7.4. These will form the basis for further empirical work in our design science research process.

7.1 SOCIO-ECONOMIC OVERVIEW OF THE KOTWALIA COMMUNITY (REUBENS, 2010C)

The Kotwalia community is an indigenous tribal community from the Narmada basin in Gujarat, India (Fig. 7.1). It is one of India's 75 particularly vulnerable tribal groups, characterized by a small and diminishing size, isolation, pre-agricultural technology and low literacy (Ministry of Tribal Affairs, 2008). According to government records, there are about 5,200 Kotwalia families across 19 taluks in six districts of Gujarat; with the largest concentrations found in Vyara, Songadh and Valod taluks (Mehta, 2009). A typical Kotwalia settlement consists of 50–60 households on the fringes of forests, along the banks of rivers, or on the outskirts of villages.

Historically, tribal communities have considered the forest (and natural resources in general) as common property. The Indian Forest Act of 1865, however, gave Britain control over India's forests and common pasture. Since the Kotwalia are not traditionally a farming community, its members did not usually own land. By the end of the 1860s, they had also lost access to the forests from where they gathered bamboo, their primary input material. Even in postcolonial times, the Kotwalia—and many other forest-dependent communities—struggle for access to grazing lands and minor forest produce needed for their sustenance and their craft (Balooni, 2002; Sharma, 2007). Prevalent government policy allows for

800 bamboo poles per Kotwalia household annually, but most Kotwalia are not literate enough to follow through with the paperwork required to avail this quota.

Figure 7.1: Map of India; the location of the Kotwalia community is represented by the black dot (Reubens, 2010)

Today, most members of the Kotwalia community migrate seasonally in search of wages, as the replacement of traditional bamboo products with industrial substitutes(Fig. 7.2) has deprived them of a large part of their income. With no economic or productive skills other than bamboo working and no land to farm, most Kotwalia work as bonded labor in sugarcane plantations under highly exploitative conditions. An average family of four earns less than INR 20,000 ($400) annually (Mehta, 2009).

Figure 7.2: Plastic substitutes have replaced traditional bamboo products (Reubens 2010)

CURRENT STATUS VIS-À-VIS TRADITIONAL SOCIO-ECONOMIC SYSTEM

Most Kotwalia families identify themselves as Kotwalia-Gamit, Kotwalia-Chaudhary, or Hindu-Kotwalia, depending on the vicinity of their settlement with the dominant tribal community, i.e., Gamit, Chaudhary or Vasava. This is because a substantial number of Kotwalia function as farm labor for these agrarian tribal communities, and there is an informal system of interdependence due to this relationship. Despite this, the Kotwalia are alienated in the larger tribal social system. There are no systems of organized social customs and norms—*vyavhaar*—for landed tribal communities to interact with the Kotwalia.

SOURCES OF INCOME

The main sources of livelihood of the Kotwalia community include agricultural labor, bamboo craft (Fig. 7.3), cattle rearing, and fishing. Only around 13% of families depend on a single source of income; 47% of families depend on two or more sources of income listed earlier. While only 6.7% of families depend solely on bamboo for their livelihood, more than 88% listed bamboo as their secondary source of income. This suggests that though bamboo is their traditional primary source of livelihood, it no longer allows them to meet their income needs. Consequently, the community is now forced to supplement its income through other low-skill labor activities, such as sugarcane labor.

Figure 7.3: Kotwalia women crafting agricultural baskets from bamboo (Reubens 2010)

ECONOMIC ASSETS

Only around 4% of the families surveyed own agricultural land, which varies between 0.5 and 1 acre in size. Almost 55% of families surveyed own poultry. Three-fourths of these families use the poultry for their own consumption; they rarely sell the birds or their eggs for supplementary income. Almost an equal number (73%) of families do not own cattle. The remaining 27% own at least two animals, with 15.6% owning goats. Families that own milk animals supply approximately four liters of milk to the local cooperative every day.

ANNUAL INCOME AND DEBT

Most (92%) of the households surveyed had a monthly income of less than INR 3,000 per month. About 80% of respondents stated that their average monthly income is insufficient to run their households.

A situational analysis reveals that the Kotwalia are perennially and chronically indebted: almost 40% of the families surveyed are in debt. Of these, 67% families are indebted to private money-lenders, while 33% families have taken institutional loans from BAIF Development Research Foundation (an NGO) for cattle. Almost 70% of families have a debt of less than INR 1,500 (roughly half their monthly income) while 80% have a debt which is less than INR 5,000 (roughly double their monthly income). A substantial portion of the community's income therefore goes towards repaying debts to moneylenders at exorbitant rates of interest—ranging from 140% to 200% per annum. The principal source of credit available to these families is the labor contractors who employ them to work in the sugarcane fields.

HOUSING AND INFRASTRUCTURE

As much as 95% of the families surveyed live in a house that they owned, but only around 28% of these houses are constructed on their own land. Around half of the families have access to electricity, while only 12.3% have toilets. More than 80% of households rely on a hand pump located 100–200 meters away from their homes for access to water, while 13% use the village well, tank, canal, or carry water from the river.

The Kotwalia do not avail of social and economic development schemes available to them since distress migration—and the lack of settled life that necessarily follows such a migration—means most of them are unaware that such schemes even exist. Distress migration also affects basic shelter needs. When they leave their villages to work on sugarcane farms, they use branches and plastic sheets to build very poor rudimentary temporary shelters for themselves (Fig. 7.4).

Figure 7.4: Typical temporary shelters of Kotwalia agricultural labor, made from branches and plastic sheets (Reubens 2010)

ACCESS TO HEALTHCARE

More than 90% of those surveyed said that a health worker visited their village regularly, but that they had inadequate access to medical facilities when away from their village. While working in the sugarcane fields, a lack of access to clean drinking water, hygienic food, sanitation, primary healthcare and basic education are causes of serious concern with regards to their health. They are chronically ill, have a high rate of morbidity and mortality, and have poor access to personal health and hygiene facilities. Children and women are the worst affected in this situation.

A little more than 75% of those surveyed reported having had an illness in the past year, including the common cold, body ache, fever, and stomach pain. Malaria was the single most common cause of morbidity. Diarrhea, vomiting, typhoid, jaundice and stomach-related water- or food-borne ailments were very frequent. Tuberculosis and malnutrition were also commonly reported, as were stomach ulcers, stress-related pain, respiratory diseases and chest pain.

Very few Kotwalia families can afford private medical treatment. Around 68% of respondents used public hospitals, primary health clinics and local dispensaries near sugar factories for medical treatment, while 50% also sought recourse in traditional, religious and/or black magic practioners for medical treatment.

7.2 VALUE-CHAIN ANALYSIS FOR KOTWALIA BAMBOO PRODUCTS (REUBENS, 2010C)

A systemic view of any value-chain network includes value-chain actors (who deal directly with the products, i.e., those who produce, process, trade and own them), value-chain supporters (whose services add value to the product despite their not dealing directly with it), and value-chain influencers (the regulatory framework, infrastructure, policies) (Roduner, 2007).

The value-chain analysis of bamboo products crafted by the Kotwalia community (Fig. 7.5), presented below, reveals the potential and bottlenecks in each grouping, as well as in the dynamic interactions between them.

ACTIVITY	VALUE-CHAIN ACTOR	VALUE-CHAIN SUPPORTER	VALUE-CHAIN INFLUENCER
Growing, management and harvesting	• Forest department • Central Paper Mills • Private farmers • Homestead bamboo owners • Village panchayat	• NGOs	• Forest department • Forest and environment department • National Bamboo Mission • Revenue department • Irrigation department • Village panchayat • Tribal development department
Transport	• Kotwalia craftspeople	• NGOs	• Forest department
Design	• Kotwalia craftspeople	• **Design consultants and institutions**	• Development Commissioner of Handicrafts (DC(h)) • National Mission for Bamboo Applications (NMBA) • Gujarat Rural Industrial Marketing Corporation (GRIMCO) Ltd
Processing	• Kotwalia craftspeople	• NGOs • **Design consultants and institutions**	• NMBA • NABARD • Tribal development department • GRIMCO
Marketing	• Kotwalia craftspeople • Middlemen • Private stores • NGO stores • Government outlets and emporiums	• **Design consultants and institutions**	• NMBA • NABARD • Government of India • Gujarat tourism department • Gujarat State Forest Development Corporation • GRIMCO

Figure 7.5: Value-chain analysis of bamboo products crafted by the Kotwalia community (Reubens 2010)

GROWING, MANAGING, HARVESTING

VALUE-CHAIN ACTORS

Kotwalia Craftspeople

Almost all the bamboo available to the Kotwalia craftspeople, and indeed available within the region, comes from the forest. As discussed earlier, as the Kotwalia are a landless community, they do not grow bamboo—they harvest green bamboo from the forest. While the state's forest department legally owns this bamboo, the Kotwalia believe that denying them free access to forest bamboo is a violation of their customary rights.

There have been a series of confrontations between the Kotwalia and the forest department. In a focus-group discussion, craftspeople reported being harassed, physically abused, penalized and molested by forest department officials when attempting to extract bamboo from the forests. They also believe that the forest department has intentionally attempted to eradicate forest bamboo in order to eliminate the need to deal with Kotwalia incursions into the forests, and their claim for customary rights to forest lands.

Meanwhile, the Kotwalia have been reported to uproot timber plantations on *forest land*, which the community reports is actually common village property. Simultaneously, the Kotwalia community continues to steal forest bamboo and process it into baskets in illegal camps, deep in the forest.

Forest Department

Bamboo is listed as a non-agricultural crop in India, which is why the forest department is one of the key value-chain actors in bamboo harvesting, trade and transit. Forests became state property through the Indian Forest Act of 1927, under which areas were declared to be government forests without recording traditional forest-dwelling and forest-dependent communities, and their customary rights and forest-management systems. The Scheduled Tribes and Other Traditional Forest Dwellers Act 2006, is a step towards legal recognition of the rights of traditional forest-dwelling communities. However, bamboo is technically excluded from the provisions of this Act because until the Indian Forest Act is amended, bamboo is to be treated as a grass in India, as per a Supreme Court ruling. Currently, the Indian State is in the process of sorting out where to transfer the ownership of bamboo. While the forest department is reluctant to give up control of the bamboo resource, it has undertaken a large-scale program to create new joint forest-management committees. In some villages, the president of the Forest Rights Committee has also been appointed the head of the Joint Forest Management Committee—a move which some believe is an effort to dilute the Forest Rights activity.

Central Paper Mills

The Central Paper Mills is an integrated pulp and paper mill, with an installed capacity of producing 55,000 tons of paper per annum, using bamboo and hardwood as the input material. The mill extracts bamboo from designated tracts in natural forests, through a lease from the Gujarat Forest Department. It meets nearly 70% of its pulpwood requirement from this bamboo. It is also actively carrying out a social and farm forestry program to reduce its reliance on forest bamboo. This includes distribution of bamboo seedlings to farmers free of cost, to encourage commercial bamboo plantations on private lands, and also planting bamboo rhizomes in degraded forest lands of their lease area.

Private Farmers and Homestead Bamboo Owners

Local farmers, from communities such as the Gamit and the Chaudhary, locally supply bamboo that grows within or around the periphery of their fields and homesteads.

Village Panchayat

Gram panchayats are village-based, grassroots-level statutory institution of rural self-government in India. The local village panchayats control the unmanaged bamboo resource growing in common lands near the village. Village members can harvest this bamboo in consultation with the Sarpanch (head of the panchayat) for a nominal fee.

VALUE-CHAIN SUPPORTERS

NGOs

NGOs with expertise in bamboo plantation, management and harvesting can help backstop the community, forest department, and other stakeholders who are involved in raising bamboo. The inputs would allow for generating mother stock of more commercially viable species, and also for improving of the productivity of each clump and the quality of each culm. In addition, NGOs working in the area of the Forest Rights Act and tribal rights can help facilitate the implementation of the Act by backstopping the community in the area of procedure, in filing claims and also by creating awareness regarding the Act. These NGOs can help to implement the Act, and then facilitate the linkage with technical bamboo-resource experts so that the community is able to grow bamboo on this land in a scientific manner. NGOs currently working in this domain include the Eklavya Foundation, the Tapini Bamboo Development Centre, BAIFDevelopment Research Foundation, Centre for Indian Bamboo Resource and Technology and the Aga Khan Foundation.

VALUE-CHAIN INFLUENCERS

Forest Department

Currently, the Gujarat Forest Department is a key value-chain supporter because it officially controls the bamboo resource and regulates its supply—including to the community, paper mills, and bamboo contractors and traders. The forest department can help protect the customary rights of vulnerable forest communities—such as the Kotwalia—vis-à-vis industries that have rights to the bamboo resource through long-term lease contracts. A step in this direction is a policy under which Kotwalia families are entitled to a quota of bamboo from the forest department. The department can also address existing policies for bamboo harvesting—such as the current policy which maximizes the output of dry bamboo to paper mills, rather than the output of green bamboo for artisans—to include the needs of forest communities.

Forests and Environment Department

The Forests and Environment Department is instrumental in facilitative policy with regards to expediting forest-settlement issues and dwellers' rights, utilizing the Japan Bank International Cooperation fund for afforestation, increasing the network of Joint Forest Management Committees and expanding the coverage of eco-clubs.

National Bamboo Mission

The National Bamboo Mission is a Central Government–sponsored scheme, which, through its policies and initiatives, aims to backstop the bamboo sector by addressing resource issues of a) increasing areas under bamboo cover, and b) introducing improved varieties to enhance yield.

Irrigation Department

The irrigation department is instrumental in making canal-side land available for community-managed bamboo plantations. This would both help protect the banks of the canals from erosion, and simultaneously make bamboo available outside the forest for the community.

Village Panchayat

The village panchayat can make available village wastelands, and common lands for bamboo plantations to be managed and accessed by the community. This would help in reclaiming degraded lands, and simultaneously make bamboo available outside the forest for the community.

Tribal Development Department

The Kotwalia community is a priority area for the Tribal Development Department (TDD), as they are notified as being *particularly vulnerable*. The department can integrate bamboo plantation into its programs—including existing Wadi, National Rural Employment Guarantee Act (NREGA) and Vanbandhu Kalyan Yojna initiatives.

TRANSPORTATION

VALUE-CHAIN ACTORS

Kotwalia Craftspeople

Over the years, the dwindling forests have become more and more distant from Kotwalia habitations. Furthermore, the forest policy has restricted Kotwalia access to forest bamboo. Most Kotwalia craftspeople walk up to 70km to access the resource, and each artisan is only able to carry back around 10–15 bamboo poles. The communities harvest bamboo from the nearby forest ranges of Mandvi, Songadh, Vyara, Navsari and the Dang region. As harvesting bamboo from the forests is illegal, the Kotwalia go to the forest individually or in groups, staying there for two or three months while they harvest forest bamboo and weave it into baskets and other products; they then carry these products back to their villages for sale.

Private Transporters

Due to the recent policy of the forest department where Kotwalia are allotted a lumpsum quota of bamboo, the Kotwalia use private transporters to carry the bamboo back to their villages.

VALUE-CHAIN SUPPORTERS

NGOs

NGOs organize community members who avail the bamboo quota from the forest department into formal and informal groups. The bamboo quota of each group member is loaded into a common vehicle and transported to their village or a common point, thereby reducing the transportation cost for each member.

VALUE-CHAIN INFLUENCER

Forest Department

The forest department is ideally placed to create a facilitative policy environment and mechanism for transporting bamboo to Kotwalia claimants in a cost-effective and uncomplicated manner.

DESIGN

VALUE-CHAIN ACTORS

Kotwalia Craftspeople

The design of traditional bamboo agrarian products has evolved over time through the craft tradition. The consumer is also an important part of the innovation process, because many new product developments and changes in traditional products have been caused by a customized requirement from the consumer. New product development by craftspeople has been limited, as they are unable to perceive of markets apart from those to which they traditionally catered. Those artisans who have received inputs from NGOs are better equipped to interpret new designs introduced to them by designers.

VALUE-CHAIN SUPPORTERS

Design Consultants and Institutions

Design consultants can help Kotwalia craftspeople connect with new markets through new designs. These design consultants are often employed by development agencies as input providers, and are sometimes entrepreneurs who run design ateliers.

National design institutions, such as the National Institute of Design and the National Institute of Fashion Technology can reach out to craftspeople—such as those from the Kotwalia community—through their outreach activities.

VALUE-CHAIN INFLUENCERS

Development Commissioner (Handicrafts)

The office of the Development Commissioner of Handicrafts (DC(h))—under the Ministry of Textiles—has several schemes for the bettermentof Indian artisans. The DC(h) conducts skill up-gradation and design-development workshops for artisans through its panel of designers.

National Mission for Bamboo Applications

The National Mission for Bamboo Applications (NMBA) aims to expand the bamboo sector in line with India's efforts to augment economic opportunity, income and employment. Design and product diversification are among its core areas.

Gujarat Rural Industries Marketing Corporation Ltd

Gujarat Rural Industries Marketing Corporation (GRIMCO) Ltd is a fully funded corporation working for the benefit of the cottage-industries sector. Its objectives include training and technical assistance to craftspeople.

PROCESSING

VALUE-CHAIN ACTORS

Kotwalia Craftspeople
Kotwalia craftspeople traditionally process green bamboo into agrarian products for local consumption. They need to be capacity-built on production streamlining, use of tools, jigs and machinery and production costing. They also require access to production-related funds, such as earnest money, and basic capital to generate stocks.

VALUE-CHAIN SUPPORTERS

NGOs
NGOs with expertise in bamboo skill-development programs and bamboo production streamlining are important supporters of the production-and-processing segment of the value chain.

Design Consultants and Institutions
Design consultants and institutions working with design and development for artisan groups often support them in areas such as building production protocols, costing and scheduling.

VALUE-CHAIN INFLUENCERS

National Mission for Bamboo Applications
NMBA aims to expand the bamboo sector in line with India's efforts to augment economic opportunity, income and employment. Establishing integrative models of small-scale enterprise, developing machinery and tooling and providing technology support are among its thrust areas.

National Bank for Agricultural and Rural Development
NABARD actively works towards the creation of non-farm employment opportunities in rural areas, especially in the artisan sector. NABARD's programs include production aspects, such as training of and by master craftsmen, artisans' guilds, common service centers and rural entrepreneurship development.

Tribal Development Department
TDD is mandated to tribal development, and the Kotwalia community—as one of India's most vulnerable tribes—is one of its focus areas. The department could help facilitate an enabling environment for the Kotwalia community to produce and process bamboo.

National Bamboo Mission
NBM is a centrally sponsored scheme whose mission includes the promotion, development and dissemination of technologies, and the generation of employment for skilled and unskilled persons,

especially youth. Both of these are very much in line with helping to improve the quality and quantity of production by Kotwalia craftspeople in Gujarat.

Gujarat Rural Industries Marketing Corporation Ltd

GRIMCO Ltd is a national corporation mandated to work for the benefit of the cottage-industries sector. Its objectives include organizing production through individual artisans and production centers. GRIMCO is already working with a bamboo cluster in Bhoostar, Valsad. It is planning to build common work sheds to provide infrastructure to the beneficiaries. A similar linkage with the Kotwalia community can be envisaged.

MARKETING

VALUE-CHAIN ACTORS

Kotwalia craftspeople

Products produced by Kotwalia craftspeople are generally sold from their residences or through village *haats*. The low-cost products are generally purchased by members of the local village community.

Middlemen

Products produced by the Kotwalia craftspeople are also marketed through middlemen in towns and cities such as Vyara, Songadh, Mandvi and Surat. Often, the village shopkeeper functions as the middleman. Generally, the middleman contacts and gives an order of around 100–200 baskets to a craftsperson, who in turn coordinates with his neighboring craftspeople to fulfill the order. When he receives the payment, he shares it proportionately with the other craftspeople.

Private Stores

A limited number of products produced by the Kotwalia community are marketed in private stores—ranging from neighborhood corner shops to upmarket lifestyle stores in cities.

NGO Stores

The NGO sector works towards the creation of non-farm employment opportunities in rural areas, especially for artisans, and facilitates the marketing of non-farm artisanal products through rural *haats* and exhibitions.

Government Stores

A limited number of products produced by the Kotwalia community are marketed in government outlets and emporiums in towns and cities.

VALUE-CHAIN SUPPORTERS

Design Consultants and Institutions

Design consultants can help Kotwalia craftspeople connect with new markets through the branding of their new designs. These design consultants are often employed by development agencies as input providers, but are sometimes entrepreneurs who run design ateliers.

National design institutions, such as the National Institute of Design and National Institute of Fashion Technology can reach out to craftspeople—such as the Kotwalia—through their outreach activities.

VALUE-CHAIN INFLUENCERS

Government of India

The Government of India can create a facilitative policy environment for marketing bamboo products by issuing a directive/policy which favors bamboo furniture and products. This would open up the entire institutional market to the Kotwalia, and other such bamboo-working communities across India. Doing so would also send a message that bamboo is sustainable, and that the nation supports bamboo-based products and enterprises.

Tourism Department

The Gujarat tourism department can be instrumental in promoting bamboo through its ecotourism initiatives. These initiatives would provide viable marketing outlets for the supply of value-added products produced by the Kotwalia community.

Gujarat State Forest Development Corporation

The Gujarat State Forest Development Corporation (GSFDC) translates, on the ground, the state policy of protecting the economic interests of Scheduled Tribes, Scheduled Castes and other weaker sections of society. GSFDC mainly works in the area of minor forest produce—including towards eliminating exploitation of forest dwellers dependent on minor forest produce from private trade.

Gujarat Rural Industries Marketing Corporation Ltd

GRIMCO Ltd is a national corporation mandated to work for the benefit of the cottage-industries sector. It facilitates market linkages through village and national fairs. A similar linkage with the Kotwalia community can be envisaged.

7.3 CRAFT OF THE KOTWALIA COMMUNITY (REUBENS, 2010C)

A majority of the Kotwalia community—both men and women—practice bamboocraft as a secondary source of income; and practice their craft around the year. Some of the salient points of their bamboo craft production-to-consumption system are discussed below.

RAW MATERIAL

The Kotwalia have traditionally gathered green bamboo—which is less than two years old—from forests and other common lands. Green bamboo is required since basketry, which constitutes the main product line of the Kotwalia community, requires young and supple bamboo. The main species of bamboo used are *Dendrocalamus strictus* (locally called *Manvel*) and *Bambusa bambus* (locally called *Katis*). The Kotwalia also procure bamboo from local farmers who have bamboo growing within their fields and, sometimes, even in their homesteads.

TOOLS AND MACHINERY

The tools used in this craft are limited to a knife called a *churi* and an iron rod used for hammering called a *kuhadi* or a *karadi*. Both implements are locally available from blacksmiths.

PROCESSING

The freshly harvested bamboo culm is first stripped of its branches. It is then cut, using the *churi*, into more manageable and transportable segments, depending on the product type.

Depending on its diameter, the bamboo culm it is split into between three and nine segments. Each of these segments is further slivered into thinner sections using a *churi*. The dimensions of the splits and slivers depend on the final product. The splits and slivers are then interlaced into the final form. Often, a metal container or bamboo basket is used as a form over which the interlacing is done.

Generally, the interlacing is both radial and angular, and so the product shapes are quite diverse. There is almost no finishing imparted to the products at the moment and the craftspeople do not recall any indigenous treatments or techniques which might have been lost over time.

EXISTING PRODUCT RANGE AND APPLICATIONS

The traditional applications of bamboo by the Kotwalia community are as under:

Food

The Kotwalia eat tender bamboo shoots, which emerge in the monsoon season, as a vegetable; and when the bamboo plant flowers, they collect and grind the grain-like seeds into flour, and use it to make a kind of bread called *rotla*.

Housing

The Kotwalia traditionally live in houses in which bamboo poles make up the structure, and bamboo mats are used as walling. These mats are plastered with a combination of cow dung and mud. The under-structure of the roof is made with bamboo, covered with baked clay tiles.

Livestock-related

a) *Godavu*: Muzzle for cattle to prevent unwanted grazing
b) *Mutthi*: For keeping fodder for cattle, available in small and large sizes

Fishing

a) *Handi*: Basket for keeping fish
b) *Malai*: Fish trap made in small and big sizes made during the rainy season (Fig. 7.6)
c) *Panjru*: Fish trap made in small and big sizes made during the rainy season

Figure 7.6: Huge *malai* made from bamboo (Reubens 2010)

Storage

a) *Topli*: Multi-purpose basket for assorted storage
b) *Karandia*: Basket with lid and handle, used for storing vegetables, etc.
c) *Chabli*: For storing roti
d) *Paaladu*: Multipurpose mat which is formed into containers for storing grains, and which the Kotwalia also use as a tent when they go to harvest sugarcane
e) *Pilogataar, Kothi*: Huge basket for storing grains, which is fixed in one place and is plastered with mud and cow dung (Fig. 7.7)

Figure 7.7: Huge basket for storing grains (Reubens 2010)

Ritualistic

a) *Dev*: The Kotwalia worship different deities, which they often represent through bamboo structures of *himaliya dev, gowalia dev, dev mogra* and *jungle dev*. The Kotwalia also house stone deities in bamboo baskets (Fig. 7.8).

b) *Rangini*: A colorful headgear used during auspicious occasions such as marriages and festivals

Figure 7.8: Kotwalia deities housed in a mud-plastered bamboo basket (Reubens 2010)

Miscellaneous

a) *Pathari*: Mat used for sitting, available in small and large sizes

b) *Topi*: Bamboo hat, made on order

c) *Karandia*: Basket for keeping snakes

d) *Haathpankha*: Hand fan

e) *Daalo*: Basket for drying *papad*

f) *Supdu*: Winnow for sorting grains, in two sizes

7.4 SUMMARY AND CONCLUSIONS

This chapter offered an overview of the Kotwalia community's bamboo production-to-consumption system—including the socio-economic and cultural scenarios that form its backdrop, and the craft products that form its output. It also presented a value-chain analysis, and discussed the existing and potential value-chain actors, enablers and supporters. The aim of this was to understand this Kotwalia situation specifically, and draw parallels from it for production-to-consumption systems of non-industrial craft-based MSMEs in developing countries working with renewable materials in general.

The chapter revealed that the Kotwalia are leaving their traditional craft for alternative sources of income—including as low-skilled agricultural labor. An analysis of the systemic picture reveals that lost access to bamboo resources, the penetration of industrialized substitute products in rural markets and the evolution of local economies are the three main reasons for the decline in the number of Kotwalia who still craft bamboo. The Kotwalia can no longer freely access the ecological resource—green bamboo—which they use to craft baskets as per their traditional occupation under the social caste system in India. The traditional product range—including the traditional agrarian bamboo products listed in this chapter—is dwindling, as it is being substituted by new and more efficient substitutes made from materials like plastic and metal. The subsequent shrinking of market share in rural markets has led to a corresponding loss of income for the Kotwalia community. This forces them to migrate seasonally in search of wages, because they do not have any economic or productive skills other than bamboo working, or land to farm. Like members of several other traditional craft communities, the Kotwalia urgently require focused strategy development to allow them to access viable new markets. The income security will then help them address their own forms of unsustainability—social, economic, cultural and ecological.

The value-chain analysis reveals that, as value-chain supporters, designers can directly influence three out of the five value-chain nodes of the bamboo craft of the Kotwalia community—design, production and marketing. Development of new products, streamlining production, and connecting the community to viable markets through a design-led process can affect the sustainable development of this community, and thereby sustainability in general. If this is done in a way that is mindful of holistic sustainability, the effects can go beyond sustainable development to enforcing our core hypothesis—design can be integral to evolving commercially viable approaches which actualize non-industrial craft materials' potential for economically viable, culturally sensitive, socially equitable, and eco-friendly production, through the craft skills of a community. Possible viable design directions for revitalizing the craft of traditional communities—such as the Kotwalia—are explored in the next chapter, which also proposes a framework towards such a systemic effort.

08 THE RHIZOME FRAMEWORK

The previous chapter offered an overview on, and insights into, the production-to-consumption system of the Kotwalia community. This, in turn, provided a lens into the compound picture of production-to-consumption systems of the problem class—non-industrial craft-based MSMEs, working with renewable materials, in developing countries. The overview revealed a systemic problem which is generic to the problem class. Traditional products are being replaced by industrial substitutes, causing a decline in the traditional market shares and livelihoods of craftspeople. Consequently, craftspeople are forced to migrate in search of employment, causing tremendous socio-economic unsustainability. Since craftspeople generally find employment as de-skilled labor, their craft languishes due to lack of practice; this leads to an erosion of the very cultural capital which can constitute the basis of a differentiated market for them. The urgent need, therefore, is for a framework which outlines possibilities of craft–design collaboration towards viable new markets for craftspeople, thus enabling them to earn a livelihood through their craft. The resulting craft practice and income security will have positive spin-offs on the social, economic, cultural and ecological dimensions of the currently unsustainable scenario.

As the value-chain analysis in the previous chapter revealed, designers can support the value-chain nodes of design, production and marketing of the craft production-to-consumption system, towards helping craftspeople connect to viable new markets. This chapter offers a construct—the Rhizome Framework—which proposes a possible way forward for craft in the situation described above, through design inputs. This construct also functions as a reference point for the objectives of a solution stage of this design science research—as it outlines possible desired directions. The Rhizome Framework is the first output of the design-and-development phase of our design science research, which centers on creating artifactual solutions. Further work on the design-and-development phase will build on this framework, and will be discussed in the following chapters.

The rationale for the Rhizome Framework and its application vis-à-vis the Kotwalia community are discussed in 8.1. The next section, 8.2, presents a methodological tool called the product-library workshop, towards creating a cultural repository of craft which will inform the Rhizome Framework. The directions for craft development proposed by the Rhizome Framework are discussed in 8.3. A discussion on the areas which would gain from a meaningful interaction between designers and craftspeople, and which are factored into the Rhizome Framework, is presented in 8.4. Finally, a summary of this chapter and resultant conclusions are offered in 8.5.

8.1 UNDERSTANDING THE RHIZOME FRAMEWORK

Our research recognizes that—given the complex natures of craft and sustainability—there is no single direction in which traditional craft can, or should, evolve in order to be sustainable. The craft diversity, multitude of craftspeople, varying skill levels, and complexity of each system scenario prevalent in developing countries reinforce the idea that it is impossible to develop a single model to re-contextualize and facilitate craft evolution. This holds true for the craft sector as a whole as well as for the bamboo craft of the Kotwalia community, who represent the client class of the problem class identified by our design science research. Therefore, this research proposes the Rhizome Framework (Fig. 8.1) towards a model which will conserve cultural capital, in addition to offering different directions of craft evolution. The framework is designed to be flexible, so as to encourage and promote diversity by being adaptable to different contexts, while remaining strongly rooted in sustainability and the interconnections between its social, economic, ecological and cultural tenets.

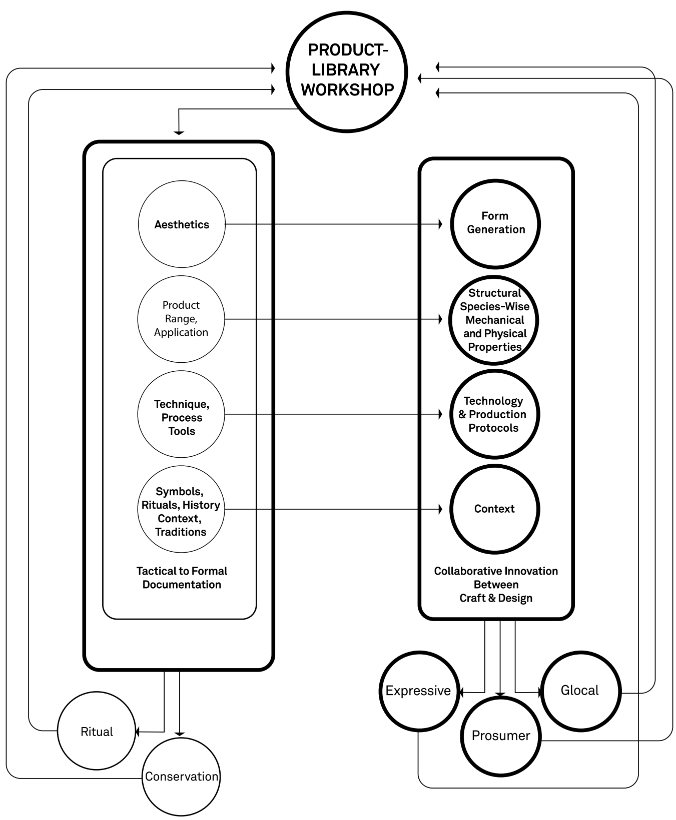

Figure 8.1: Rhizome Framework (Reubens 2010)

The Rhizome Framework is named after bamboo's complex underground rhizome system. Each rhizome either sends up a shoot or sends down a root, and networks itself to other rhizomes to form a stable mesh that prevents soil erosion. Philosophically, the Rhizome Framework draws on Deleuze and Guattari's (1987) use of the rhizome to symbolize theory and research that allows for multiple, non-hierarchical entry and exit points in data representation and interpretation. The principles of a rhizome outlined by Deleuze and Guattari (1987), and which the Rhizome Framework aspires to cultivate, are as below:

- 1 and 2: Principles of connection and heterogeneity—"Any point of a rhizome can be connected to anything other, and must be (Deleuze & Guattari, 1987, p. 7)"
- 3: Principle of multiplicity—"It is only when the multiple is effectively treated as a substantive, 'multiplicity,' that it ceases to have any relation to the One as subject or object, natural or spiritual reality, image and world (Deleuze & Guattari, 1987, p. 8)"
- 4: Principle of asignifying rupture—"A rhizome may be broken, shattered at a given spot, but it will start up again on one of its old lines, or on new lines (Deleuze & Guattari, 1987, p. 10)"
- 5 and 6: Principle of cartography and decalcomania—"A rhizome is not amenable to any structural or generative model (Deleuze & Guattari, 1987, p. 12)"; it is a map, and not a tracing

In a similar vein, the framework looks at three distinct directions, which are independently and interdependently sustainable, and prevent the erosion of social, economic, ecological and cultural capital.

The scaffolding for the framework included the scholarship on the process of designing an artifact and the deconstruction of the considerations inherent in it. This included the key elements of design—including function, aesthetics, material and production possibilities and socio-cultural concerns—which are part of foundation industrial design education (Nugraha, 2010); and Papanek's (1995) model of a *six-sided function matrix* of a designed object. Papanek's model identifies method, use, consequence, aesthetics, association and need as the six interlinked aspects of a designed object.

Adi Nugraha's ATUMICS (artifact-technique-utility-material-icon-concept-structure) framework—which aims to enable craftspeople and designers to transform aspects of tradition into new objects—has tremendous resonance with the Rhizome Framework. ATUMICS was part of Nugraha's PhD research at Aalto University, and was developed in parallel to the Rhizome Framework. It draws upon the work of several frameworks, models and scholars including the Rhizome Framework. Nugraha's (2012) PhD thesis quotes some of the concepts of the Rhizome Framework and also includes the diagram of the Rhizome Framework.

HOW THE RHIZOME FRAMEWORK WORKS

The first step in the framework is a product-library workshop (described in detail in 8.2), where craftspeople are asked to craft their complete range of traditional products using their own tools, in actual scale (Reubens, 2005). This process is documented by designers and community mobilizers. The physical library of products and the resulting documentation create a cultural repository of the aesthetics, products, techniques and contexts of craft practice, thus formalizing tacit knowledge. The cultural repository serves two purposes: recording and augmenting indigenous knowledge as cultural capital; and serving as an input for collaborative innovation between craftspeople and designers towards revitalized and sustainable directions of craft evolution.

The ritualistic contexts of traditional products recorded through the cultural repository function as reference points for substantiating the cultural identity of the craft community and its material culture. Traditional products in the sphere of the *ritual* continue to be authentically crafted for and by the community. The use of these products in traditional rites and ceremonies contributes to the vitality (Hawkes, 2001) of the community's cultural capital and, in turn, reinforces the cultural repository, which supplements conservation efforts. Authentic and ritualistic products can simultaneously be acquired by museums, connoisseurs and collectors as artifacts of anthropological, ethnographical and cultural relevance from the perspective of conservation.

Designers and craftspeople collaboratively analyze the indigenous knowledge captured through the cultural repository to identify and isolate distinct cultural markers (Hickey, 1997), which then provide direction for the evolution of the craft. These markers are factored into the collaborative innovation process as design inputs. The aesthetics of the cultural repository provide reference points for form generation; the product range and applications provide insights into the species-wise structural, mechanical and physical properties of renewable materials; the traditional techniques, processes and tools are important inputs to build on innovate pro-poor technologies and viable production protocols; and the symbols, rituals, history, context and traditions offer a basis for re-contextualization while being mindful of the community's cultural essence.

The framework proposes three directions for craft evolution (discussed in detail in 8.3), namely, *expressive*, *prosumer*, and *glocal,* targeting of sustainable and viable markets for craft, based on factoring indigenous knowledge into collaborative innovation.

The Rhizome Framework seeks to reduce the unsustainable nature of the prevailing craft practice of traditional craft communities in developing countries—such as the Kotwalia community—while constantly being mindful of the integrated tenets of sustainability. As given below, Fig. 8.1 illustrates, in the context of the Kotwalia community, how the application of the framework can change the currently unsustainable situation into to an ecologically, socially, culturally and economically sustainable situation.

SUSTAINABILITY TENET	CURRENT: UNSUSTAINABLE	PROPOSED: SUSTAINABLE
Ecological	Requires extraction of immature green bamboo	Reduces green bamboo usage by providing production options using mature bamboo
Social	Unviable livelihood; causes distress migration	Offers a recourse to distress migration by providing a viable livelihood option
Cultural	Loss of indigenous knowledge because of craft becoming obsolete and economically unfeasible	Records indigenous knowledge through the product library, and offers recontextualized direction for evolution to keep craft vital
Economic	Not viable source of income, and therefore contributes to rural debt	Provides income-opportunity directions which are rooted in viable contemporary markets

Figure 8.1: The current and proposed modes of bamboo craft for the Kotwalia community (Reubens 2010)

8.2 PRODUCT-LIBRARY WORKSHOP: A METHODOLOGICAL TOOL

The Rhizome Framework proposes the creation of a cultural repository of craft tradition and practice through the product-library workshop—a methodological tool that we first developed and used in 2002 during our association with INBAR. The workshop is based on a *making-for-documenting* process, as opposed to the typical *observing-and-documenting* process. The basic methodology involves asking craftspeople to craft obsolete and in-use products; designers, community mobilizers and other relevant stakeholders meticulously document this exercise.

The output of the workshop is a set of actual-scale products that serve as a *library* of products for further reference. The entire physical product-library and the process of crafting its contents are documented in electronic format, through photographs and video, and archived for easy circulation and access. The resulting documentation functions as a baseline indicator, and also as a cultural repository. This is a resource from which both craftspeople and designers can isolate indigenous cultural markers on which to base further innovation. The workshop and its consequent products provide an opportunity for documenters to see and record, and also to observe and analyze at a later date.

The product-library workshop gives a focused and holistic insight into craft, especially when compared to traditional methods of craft documentation that rely on field visits. While in-situ visits to craft communities give an honest account of the craft practice, they do not always reveal the exhaustive repertoire of product range or techniques; there are always waning products and techniques which—though not being produced by the current generation of craftspeople—are not yet extinct and can be reproduced on demand. Products which are used and produced seasonally are also not reflected unless the field visits are regular and over all the seasons. The product-library workshop circumvents these failings, and, when supported by field visits, provides a holistic and realistic picture of the craft range that exists and is being practiced.

ACTUALIZING THE PRODUCT-LIBRARY WORKSHOP FOR THIS RESEARCH

The *cultural-repository* component of the Rhizome Framework was trialed, through a three-day long, intensive product-library workshop as part of the empirical research. A cross section of Kotwalia craftspeople was assembled in Waghai in April, 2010, and asked to make a complete range of actual-scale traditional products using their own tools. The collection of products served as a physical product-library for our research. The exercise was designed to set baselines of the existing product range, technique, and skill level within this craft group. Information regarding bamboo harvesting, species-wise usage patterns, process and technique, tools, product range, and their applications and cultural practices, was collected through interactions with the assembled craftspeople, and validated through focus-group discussions. Designers photographed the entire workshop, and also took notes and pictures to record information on aesthetics, product range, application, techniques, processes, tools, history, tradition, and symbolic, ritualistic and utilitarian contexts. Community mobilizers facilitated individual and focus-group discussions, which were documented by the designers through notes and photographs.

The next phase of empirical research will build upon this product library, and the cultural markers it encompasses, through a bamboo design workshop where the *expressive*, *prosumer* and *glocal* directions will be fleshed out in a trial. The workshop is discussed in detail in Chapter 10.

8.3 DIRECTIONS OF INNOVATION

The Rhizome Framework proposes three directions for craft evolution: *expressive*, *prosumer*, and *glocal*; these directions are in line with the ideological and intellectual underpinning of the craft constituency which Greenhalgh (1997) identifies as consisting of three elements, namely, decorative art, the vernacular and the politics of work. The Rhizome Framework identifies opportunities for the craftsperson to be an artist (*expressive*), and/or a vernacular producer and the marketing link of an interdependent sustainable community (*prosumer*), and/or a producer and perhaps even small businessman (Greenhalgh, 1997) rooted in producing sustainable (*glocal*) products. All three directions draw from craft modes of production and technology. This framework, therefore, draws upon the three approaches that were used to promote handicraft in opposition to machine-based production: the economic, psychological and aesthetic (Greenhalgh, 1997). The economic, because technology destroys labor opportunities (*prosumer*), the psychological, whereby society loses its creativity to think because of mechanization (*expressive*), and the aesthetic, whereby human expression is better than machine-made standardization (*glocal*).

EXPRESSIVE

The *expressive* direction proposes that the cultural repository created through the product-library workshop forms the basis for product lines that are deeply rooted in maintaining cultural capital, which align craft with art. This direction has several conceptual precedents. These include the studio crafts, which are an effort to realign craft with art, and haute couture. The philosophy of Judy Frater, who conceived and founded the Kala Raksha Vidhyalaya (the first design school for traditional artisans of craft and textiles), is inspiring; the idea of craftsperson-led innovation mirrors the idea of the artist-maker. Frater argues that "the top–down solution to design innovation may dilute or diffuse the essence and strength of traditions; the unique quality which can enable artisans to survive in an increasing commoditized world (Frater, 2009, p. 44)." These limited-edition and exclusive artifacts will create an aspirational market for the craft, which will trickle down and add value to crafted products aligned to art and design. In this way, the relation between art and craft can begin to be viewed not as problematic but as productive (Adamson, Cooke, & Harrod, 2008).

PROSUMER

Futurologist Alvin Toffler (1980) coined the term *prosumer* in his book, *The Third Wave*, where he envisions the need for mass-production of highly customized products. This is ideologically in line with the craft process, where craftspeople could custom-craft pieces due to the close interaction with their consumer. The principle also extends to professions like architecture, where the consumer interacts closely with the innovator/maker.

Another parallel is in the idea of *metadata* where designers provide *seeds* or aesthetic *codes* that the users then cultivate to their own needs, e.g., self-building housing, based on a general framework from an architect (Thorpe, 2010). The *prosumer* direction proposes that cultural markers—drawn from the cultural repository created through the product-library workshop—form the point of departure for product lines that are based "on self-sufficiency through production networks (Bersalona, 2002)." The aim is to create products that members of the Kotwalia community can craft for themselves and other rural communities in the region—the idea being a self-provisioning rather than a commodities approach (Thorpe, 2010).

In *Wikinomics: How Mass Collaboration Changes Everything,* Tapscott and Williams (2006) devised the term *prosumption* to refer to the creation of products and services by the same people who will ultimately use them. Given that many corporations are viewing rural markets as important production and market bases (Humbert, 2007; Prahalad, 2004), the framework aims to allow the rural *prosumer* greater independence from the mainstream economy. Movements such as cooperative self-help that sprang up during great economic crises, and the more recent voluntary self-sufficient communities, are all precedents for this direction. In this vein, M. P. Ranjan's *Katlamara Chalo* workshop created new products and a design strategy to help craftspeople to produce bamboo products using limited resources and permit them to find local markets. This strategy also holds the potential to be adapted to further markets (Ranjan, 2009).

GLOCAL

Several not-for-profit organizations—such as Aid to Artisans in the USA, and Dastkar in India—engage designers to develop new product lines inspired by the craft of specific artisan groups; the craft groups then produce these designed products. The aim is that, "through innovation, craft can rise above subsistence into a satisfying and profitable business (Hnatow, 2009, p. 5)." This approach is ubiquitous to design intervention in developing countries, where craft is struggling to make the transition from "viable economic activity" to "ideological cultural property (Adamson et al, 2008, p. 6)"; and where craftspeople need to be linked to lucrative markets. An example in this genre includes Patty Johnson's North South Project (Johnson, n.d.), where products are produced by African craftspeople in a manner that is mindful of the sustainability of the region's community and economy.

The *glocal* direction proposes that cultural markers drawn from the cultural repository form the basis for product lines that target sustainability-aligned markets. This direction targets both domestic and foreign urban markets, where there is a demand for sustainable products. It builds on the fact that while there are several designed economically viable, eco-friendly products—e.g., bamboo board—these do not capitalize on the social and cultural potential of materials for sustainability. Products targeting urban markets, and produced by marginalized (social) craftspeople (cultural), do this effectively. *Glocal* has its precedents in the numerous occasions when designers have drawn inspiration from the craft process and tradition (Dormer, 1997) to develop avant-garde consumer products.

8.4 AREAS THAT WOULD BENEFIT FROM DESIGN–CRAFT INTERACTION

Our research agrees with Rees's (1997) argument that art, craft and design are part of a spectrum. Though they are conceptually divided, their boundaries are porous, such as in the case of haute couture, where a limited edition, statement (art) designer bag (design) may be produced by traditional leather craftspeople (craft) with extreme attention to detail, then finished in Europe, in line with the strong artisan-influenced culture of high-quality personal accessories (Dormer, 1997). Therefore, we have sought to move beyond the debate on the relevance, justification, and suitability of design intervention intraditional craft practice, a debate which is fraught with incongruent arguments and opinions (Craft Revival Trust, 2006) (discussed in detail in Chapter 5), and focus instead on the comparative advantages that both designers and craftspeople bring to the innovation process. Some of the areas which would gain from a meaningful interaction between designers and craftspeople, and which are factored into the Rhizome Framework, are as below.

MARKET ACCESS

Most traditional craftspeople, including the Kotwalia, are unable to perceive and cater to markets outside their villages because they are accustomed to traditional markets which function at an inter-village level, where there is a direct link between producers and buyers (Panchal & Ranjan, 1993; Vencatachellum, 2006). As discussed in Chapter 5, while the *know-how* (knowledge and skills) exists abundantly in the crafts sector, there is a severe shortfall in the *know-what* (strategies and designs) that curtails the ability of craft communities to survive intense competition or, better still, develop value-added solutions in the complex economic and social matrix in which they exist (Panchal & Ranjan, 1993). Designers hold the potential to elucidate modern markets for the craftspeople through collaborative innovation, and thus enable them to cope with the process and consequences of industrialization (Craft Revival Trust, 2006).

EQUITABLE ACCESS TO GAINS FROM PRODUCTION

It is important for traditional craft producers and the workforce in general to reorganize itself if it is to be able to access a portion of the economic profits of the information revolution. "The actual issue is how we want the production gains of the information revolution to be distributed, how we want the coming world to be (Humbert, 2007, p. 17)."

Technology causes radical changes in the social, economic, ecological and cultural worlds; and to sustainability in general. The Rhizome Framework therefore deliberately focuses on craft technologies, in order to secure craftspeople a higher place in the value chain. This will bring greater equitability into who controls the means of production, who labors and who profits. The Rhizome Framework advocates being *low-tech* as opposed to *technology-intensive* or following the *technology push* ideology, in order to allow the crafts practiced by thousands of craftspeople to evolve organically (Dormer, 1997) towards a sustainable end. The onus is on the designer to reference the triad of traditional material, technique and context (Metcalf, 1997), and to design the crafted contemporary artifact in collaboration with craftspeople.

RECORDING AND PROTECTING CULTURAL CAPITAL

The Rhizome Framework creates a cultural repository through the product-library workshop and its linked craft documentation. This cultural repository records and preserves indigenous knowledge and practices; this creates the foundation for concretizing the cultural capital of traditional communities as intellectual property rights and putting in place geographical indicators to protect craft capital (Craft Revival Trust, 2006). The process of creating a cultural repository enables the formalized archiving of tacit knowledge, which is traditionally transmitted orally (Craft Revival Trust, 2006), or through the apprenticeship mode, in the craft tradition. This formalization is important, because the breakdown of generational craft practice calls for complementing and supplementing traditional transmission mechanisms of craft knowledge. If this is not done, the knowledge–transfer link between generations can be broken and indigenous knowledge can be lost permanently.

INDIGENOUS KNOWLEDGE-BASED CRAFT–DESIGN COLLABORATION FOR SUSTAINABILITY

The collaboration between designer and craftsperson maximizes the skill and knowledge that each brings to the innovation process. The craftsperson brings indigenous knowledge and practices that have been validated over time as being more sustainable than not. As discussed earlier, many of the concepts of sustainability have underpinned craft practice (Rees, 1997), e.g., the use of local materials, or expertise, and production in a single material, which allows for ease in sourcing, production and repair, and also in eventual disassembly and recycling. The designer brings value with his access to information and technology on current issues, including sustainability. Both inputs are complementary and supplementary. The framework advocates adopting principles of social sustainability such as fair wages, fair trade, and banning child labor, etc., in each of the directions offered. Incidentally, these principles are inherent in the indigenous craft process; child labor and labor unions both surfaced during the process of industrialization. The framework aims to bring in sustainability by addressing the politics of labor—i.e., to address unemployment, exploitation of labor, the environment, and globalization.

8.5 SUMMARY AND CONCLUSIONS

This chapter presents the Rhizome Framework, a construct which proposes possible three viable directions for the evolution of tradition craft—the *expressive*, *prosumer*, and *glocal*—through design inputs. Such meaningful craft–design collaboration would empower craftspeople to access viable markets, access equitable gains from production, record and protect their cultural capital, and leverage indigenous knowledge in craft–design collaborations. The need and basis for the development of the Rhizome Framework is discussed in this chapter, and at length in Chapter 5. It centers on linking craftspeople to viable markets so they can have sustained livelihoods, which in turn will positively impact sustainability in a holistic manner.

In the case of the representative client class for the initial empirical research—the Kotwalia community—bamboo craft is a vital force in communicating and validating their culture and tradition. Simultaneously, bamboo's huge commercial potential can be leveraged to help contribute to large-scale employment of this indigent community, members of which do not have much capital but are rich in indigenous knowledge and have a strong skill and resource base (Ranjan, 1995). Therefore, the Rhizome Framework seeks to use indigenous knowledge as a design input during innovation. The framework functions as part of a holistic system, where natural-resource management, community mobilization and organization, market analysis, design and development, skill training, capacity building, production streamlining and institution building are part of a comprehensive strategy.

This chapter proposed the product-library workshop as a methodological tool towards evolving "[…] methods of thinking and acting, guidelines, […] that contribute to making this process a meaningful interaction between artisans and designers (Craft Revival Trust, 2006, p. 33)." The following chapter delves deeper into the area of creating a methodological tool for meaningful craft–design interaction. It presents the second output of our design science research—the Rhizome Approach—which centers on a methodology for craft–design collaboration aligned to sustainability.


GLOCAL
GLOCAL
POSITIVE
ECO
SOCIAL
ECONOMIC
CULTURAL
NEGATIVE:

09 THE RHIZOME APPROACH

The previous chapter presented the first output of the design-and-development phase of our design science research—a construct called the Rhizome Framework. This framework proposed possible directions for the evolution of traditional craft in the developing-country scenario, through design inputs. As discussed in the previous chapters, especially Chapter 5, this evolution and consequent revitalization has become urgent, given that several traditional craft production-to-consumption systems in developing countries are being jeopardized due to shrinking markets, and the subsequent loss of livelihoods, for craftspeople.

This chapter presents the second output of the design-and-development phase of this design science research, the Rhizome Approach, towards a methodology for design–craft collaborations. The Rhizome Approach was developed as part of this PhD research in 2010, towards empowering designers to leverage craft production-to-consumption systems in developing countries for sustainability design—including through the directions outlined in the Rhizome Framework.

Section 9.1 discusses the background and rationale for the development of the Rhizome Approach, while 9.2 presents the seven steps of the Rhizome Approach and the mechanisms designed to actualize these steps. Finally, 9.3 summarizes the chapter, and offers conclusions thereon.

9.1 THE RHIZOME APPROACH: TOWARDS MEANINGFUL CRAFT–DESIGN COLLABORATIONS FOR SUSTAINABILITY

As discussed in 4.2, the serendipitous push and pull that positions design to act as an enabler to sustainability is augmented by the design skill set. Despite this, as discussed in 4.5, it appears that the interest in sustainability and sustainable design (Fuad-Luke, 2009) has not translated into frequent practice by designers in developed (Aye, 2003; Kang et al, 2008; Kang & Guerin, 2009; Mate, 2006), or in developing countries (Hankinson & Breytenbach, 2012). The literature review revealed that the reasons for this (4.5) include, a) lack of knowledge about sustainability, b) lack of holistic overview of production-to-consumption systems and value chains, c) failure to include sustainability at a strategic level in the overall approach, d) failure to include sustainability criteria in the design brief, e) lack of a collaborative design process, f) lack of tools, and, g) failure to keep design teams in the loop during the product actualization process. In response to these barriers gleaned from the literature review, we developed the Rhizome Approach as the second output of our design-and-development phase.

The Rhizome Approach—like the Rhizome Framework—is named after bamboo's complex underground rhizome system, and has its philosophical underpinnings in work of Deleuze and Guattari (1987). A detailed discussion on this is offered vis-à-vis the Rhizome Framework (8.1); this also holds for the Rhizome Approach.

The Rhizome Approach was developed towards equipping designers to design such that they approach and impact sustainability in a holistic manner—especially in the context of design for and in developing countries when working with renewable materials in craft production-to-consumption systems. The Rhizome Approach advocates the reemergence of systemic thinking in the design process towards sustainability design, through collaborative innovation between designers and craftspeople.

RATIONALE FOR THE RHIZOME APPROACH

As discussed in Chapter 1, designers working towards sustainability with renewable materials from developing countries—such as bamboo, cork and sea grass—which are not traditionally part of mainstream industrial value chains, tend to focus on the material's ecological and economic potential. While the resulting designs are eco-friendly (ecologically sustainable) and marketable (economically sustainable), they do not capitalize on the potential of these materials to contribute to social and cultural sustainability. These materials can help facilitate holistically sustainable and inclusive development because they are traditionally part of production-to-consumption systems which involve a large number of indigent producers—including marginalized groups such as women, craftspeople and ethnic minorities. Our research argues that design–craft collaboration at the innovation stage has the potential to go beyond impacting the ecological and economic tenets, to addressing all the dimensions of sustainability holistically. This, in turn, offers the possibility of side-stepping the various forms of unsustainability of the mainstream industrial paradigm in the context of MSMEs in developing countries.

Craft offers a valuable input into sustainable design and counter-balances the ethos of industrial design (Tonkinwise, 2015). In contrast to industrial design—which is driven by industry, craft is driven by the integration of tacit knowledge, innovation, skill, bioregional knowledge (Ihatsu, 2002) and traditional practices. All of these link into a single system determined by the interconnectedness between people, land, materials and energy (Ihatsu, 2002). If design manages to tap into craft's slowness, richness (Tonkinwise, 2015), and indigenous knowledge systems, it can also leverage the systems of social, ecological, cultural and economic sustainability that underpin them. Collaborating with craftspeople offers designers a window into systemic production-to-consumption systems, and the opportunity to orchestrate and be part of a value chain that is localized and transparent—where stakeholders have greater accountability to each other, and the outcome of the production-to-consumption system in general.

Collaborative innovation also offers the potential to go beyond designing products to designing production-to-consumption systems that underpin products—specifically, through production-to-consumption systems that are in line with the needs of developing countries and the concept of holistic sustainability—which are non-industrial, labor-intensive, localized, and community-centric.

This research therefore presents the Rhizome Approach towards a flexible methodology for collaborative, sustainable innovation—especially between a craftsperson and a designer. The reason for incorporating flexibility in the approach was to ensure that it was adaptable to each specific scenario that fell within the larger problem class which the approach aimed to address.

9.2 THE RHIZOME APPROACH

The table below (Fig. 9.1) provides an overview of the Rhizome Approach, including the barriers which informed its seven steps, the steps, their aim, and the envisaged method for operationalizing the steps.

STEP	BARRIER	AIM	METHOD
1	Lack of knowledge about sustainability	Inform designers about sustainability, and the connections between its tenets	Provision of background reading material covering the connections between sustainability, design, material and the production-to-consumption system
2	Lack of a holistic overview of the production-to-consumption system	Sensitize designers to the systemic production-to-consumption system	Exposure visits to stakeholders of the different nodes of the value chain and production-to-consumption system
3	Failure to include sustainability at a strategic level in the overall approach	Factor sustainability into the strategic blueprint of the enterprise	Introducing a blueprint, towards which all the participants of the collaborative design process will work together collectively
4	Failure to include sustainability criteria in the design brief	Articulate sustainability criteria in the design brief so that it can be factored into the front-end design phase	Clear brief supplemented by the Sustainability Checklist to clarify desired design and its impact on each tenet of sustainability
5	Lack of a collaborative design process	Provide inputs from different stakeholders towards a collaborative design process	Constant linkage and interaction with stakeholders of the production-to-consumption system during the design process
6	Lack of tools to measure holistic sustainability against indicators	Increase designers' accountability to factor sustainability into their designs and provide a tool to measure the sustainability achieved	Evaluation of the design against the Sustainability Checklist by the designer and two external evaluators
7	Failure to keep the design team in the loop during product actualization	Keep designers in the loop until final product actualization thereby retaining their responsibility for the product's sustainability	Involving the design team in all iterations of the design, up to final product actualization

Figure 9.1: Overview of the Rhizome Approach (Reubens 2015)

The seven steps of the Rhizome Approach are elaborated upon below:

STEP 1: PROVIDING KNOWLEDGE AND INFORMATION ON SUSTAINABILITY

As discussed in 3.5, designers need to understand sustainability as a systemic construct in order to factor it into their design process. Designers need to appreciate the links between the tenets and, better still, understand them (Shedroff, 2009). Since sustainability is yet to become part of the mainstream in design education (Hankinson & Breytenbach, 2012), and the limited design literature on sustainability focuses on ecodesign, most designers studying and practicing sustainable design tend to focus on the ecological tenet and not on the holistic picture (Maxwell et al, 2003). Following their design education, a large percentage of designers fail to expand their sustainability knowledge in their practice—either by working on sustainability-related projects, or through professional peer exchange platforms such as conferences (Hankinson & Breytenbach, 2012). Consequently, they lack knowledge on sustainable materials (Mate, 2006), their impact (Kang & Guerin, 2009), and sourcing (Hankinson & Breytenbach, 2012).

The first step of the Rhizome Approach therefore advocates bridging the theoretical knowledge gap on sustainability, by providing designers with information through focused presentations and reading material.

STEP 2: ENABLING A HOLISTIC OVERVIEW ON PRODUCTION-TO-CONSUMPTION SYSTEMS AND VALUE CHAINS

As discussed in 3.5, designers tend to focus on the organization but not on its forward and backward linkages (Maxwell et al, 2003). Looking at the entire picture—and thereby being able to assess the reliability of suppliers and vendors—is becoming increasingly challenging and important, given that production-to-consumption systems are now spread across nations (Hankinson & Breytenbach, 2012). Designers therefore tend to focus on addressing easily visible problems such as ecological unsustainability—rather than exploring integrated issues and reaching holistically sustainable systems solutions (Maxwell et al, 2003).

Step 2 therefore advocates supplementing the didactic learning from Step 1 with hands-on exposure to the entire production-to-consumption system. The aim is to facilitate experiential learning—including by first-hand visits to the different nodes of the value chain—to understand how the independent actors of the production-to-consumption system collectively impact sustainability. Realistically, this understanding will probably not allow designers to influence the behavior of each actor in the production-to-consumption system. However, understanding the collective motivations and compulsions of the actors that comprise the system can be the basis for the design of an optimal solution that weighs and prioritizes the trade-offs between the individual motivation and compulsion of each actor.

STEP 3: INCLUDING SUSTAINABILITY AT A STRATEGIC LEVEL

As discussed in 3.5, a business would need to include sustainability at a strategic level for its key systems—including design—to internalize sustainability concerns (Maxwell et al, 2003). Sustainability often seems to involve extra effort (Hankinson & Breytenbach, 2012) and costs (Aye, 2003; Mate, 2006). In addition, sustainable solutions require more time (Bacon, 2011; Hankinson & Breytenbach, 2012) for sourcing (Aye, 2003) and research (Hankinson & Breytenbach, 2012). In order for sustainability to be factored into innovation and design—despite the apparently extra effort with no clear immediate benefits (Hankinson & Breytenbach, 2012)—it needs to be championed as a key part of an organization's strategic approach.

Step 3 therefore focuses on introducing sustainability into an organization's strategic blueprint, towards which all the participants of the collaborative design process will work together collectively.

STEP 4: INCLUDING SUSTAINABILITY CRITERIA IN THE DESIGN BRIEF

As discussed in 3.5, sustainability is often seen as an expensive (Aye, 2003; Mate, 2006; Bacon, 2011) add-on to the design brief that conflicts with the functional requirements of the product (Hankinson & Breytenbach, 2012; van Hemel & Cramer, 2002), rather than as an integral part of it. Including sustainability in the design brief—right in the front-end stage (Dewulf, 2013)—would minimize the need to clean up several consequences of the product life cycle (White et al, 2008). Step 4 therefore advocates including sustainability in the design brief and clearly outlining the criteria desired in the design, and their impact on each tenet of sustainability through the Sustainability Checklist (Fig. 9.2) developed through this design science research process.

	PRODUCTION-TO-CONSUMPTION CHAIN	SUSTAINABLE DESIGN PARAMETER	ECOLOGICAL TENET	ECONOMIC TENET	SOCIAL TENET	CULTURAL TENET	CRAFT PROCESS
1	MATERIAL SELECTION CONSIDERATIONS	Cleaner	•				
2		Renewable	•				
3		Low energy-consumption	•	•			•
4		Biodegradable	•				•
5		Recyclable	•				•
6		Recycled	•				•
7		Supplied by poor/ marginalized/local producers	•	•	•		•
8		Fairly traded	•		•		•
9		Sustainably harvested and managed	•	•			•
10		Minimum treatment for processing	•				
11		Background of local/indigenous production systems			•	•	•
12	PRODUCTION CONSIDERATIONS	Minimum material	•	•			•
13		Less harmful/sustainable combination materials	•		•		•
14		Indigenous treatments and processes	•		•	•	•
15		Less emissions	•		•		•
16		Minimum production steps	•	•			•
17		Renewable energy used	•				
18		Less waste generated/waste reused	•	•		•	•
19		Material reduction through efficiency	•	•			•
20		Healthy and safe working environment			•	•	•
21		Fair wages and benefits to producer			•	•	•
22		Non-discriminatory			•	•	•
23		Employment to marginalized producers			•	•	•
24		Capacity-building of producers		•	•	•	•
25		Producers involved in decision-making			•	•	•
26		No child and forced labor			•	•	•
27		Respect for human rights of producers			•	•	•
28		Indigenous representation in decision-making affecting indigenous resources			•	•	•

	PRODUCTION-TO-CONSUMPTION CHAIN	SUSTAINABLE DESIGN PARAMETER	ECOLOGICAL TENET	ECONOMIC TENET	SOCIAL TENET	CULTURAL TENET	CRAFT PROCESS
29	DISTRIBUTION CONSIDERATIONS	Minimum weight	•	•			
30		Reduction in distribution volume/ weight	•	•			•
31		Minimum packaging	•	•		•	•
32		Clean/cleaner packaging	•			•	•
33		Reusable packaging	•			•	•
34		Recyclable packaging	•				•
35		Packaging made from reused/ recyclable material	•			•	
36		Energy efficient transport for distribution	•				•
37		Localized production and distribution systems to reduce physical production to delivery gap	•	•	•	•	•
38	CONSUMER USE CONSIDERATIONS	Low energy-consumption during usage	•			•	•
39		Clean energy-consumption during usage	•			•	•
40		Reduction of disposable auxiliary materials through permanent product feature	•				•
41		Efficient use of consumables during usage	•				•
42		Use of clean consumables during usage	•				•
43		Safe for users' health	•		•		•
44		Customizable	•	•		•	•
45		User-friendly		•	•	•	•
46		Affordable			•		•
47		Easy to maintain and repair				•	•
48		Easily upgradeable	•			•	•
49		Classic design	•			•	•
50		Promote a strong user–product relationship			•	•	•
51		Locally repairable and maintainable	•		•		•

	PRODUCTION-TO-CONSUMPTION CHAIN	SUSTAINABLE DESIGN PARAMETER	ECOLOGICAL TENET	ECONOMIC TENET	SOCIAL TENET	CULTURAL TENET	CRAFT PROCESS
52	END-OF-LIFE HANDLING CONSIDERATIONS	Classic design and robust quality enabling product to be passed down and reused	•		•	•	•
53		Designed for disassembly	•		•	•	•
54		Mono-material	•				
55		Recyclable	•				
56		Toxic harmful materials easily isolatable for separate disposal	•		•		
57		End-of-life handling facilitate employment for local communities through recycling			•		•

Figure 9.2: Sustainability Checklist (Reubens 2011 adapted from Crul and Diehl 2006 + ILO directives)

The starting point for the checklist was the seven meta rules of thumb with 105 detailed rules developed in the Design for Sustainability (D4S) Manual (Crul & Diehl, 2006). The rules of thumb in the D4S Manual, in turn, drew on Module B (Optimization of the End-of-life System) and Module G (The Environmental Problem) of the Dutch PROMISE manual for Ecodesign (Brezet, Horst, & Riele, 1994), the Life-Cycle Design Guidance Manual (Keolian & Menerey, 1993), the OTA Green Products by Design (United States Congress, 1992), the German standards VDI 2243 guidelines and compatibility tables for recycling (1993) and the GEP Design for Recycling guide (Industry Council for Electronic Equipment Recycling, 1993). The Sustainability Checklist was developed by creating a list by grouping and shortlisting the rules of thumb from the D4S Manual (Crul & Diehl, 2006). This list was supplemented with inputs from the ILO's international declaration on fundamental principles and rights at work and its follow up (1998) and conventions and recommendations (2016) (Fig. 9.3). The final list was mapped against a generic production-to-consumption system, and the four pillars of sustainability and craft.

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
MATERIAL CONSIDERATIONS	Renewable	Use renewable materials	
	Minimally treated	Avoid additional surface treatment	
		Do not use paint if possible	
		Use efficient painting techniques	
	Recyclable	Use recyclable materials	
	Recycled	Use recycled materials	
	Local materials	Use local materials	
	Fair trade	Use fair trade materials	
		Use certified materials	
		Use materials with social benefits	
		No toxic materials or additives	
		Avoid materials from intensive agriculture	
		Avoid energy-intensive materials	
PRODUCTION CONSIDERATIONS	Minimum material		
	Minimum production steps	Reduce number of production steps	
	Renewable energy	Use renewable energy sources	
		Save energy for production	
		Avoid toxic substances	
	Less emissions	Use low-emission techniques	
		Use water treatment systems	
		Recycle production residues	
	Less waste generated	Reduce production waste	
	Waste reused	Reuse production waste	
		Reduce number of rejects	

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
PRODUCTION CONSIDERATIONS	Indigenous treatments and processes	Use natural treatment	
		Preserve local culture	
	Indigenous representation in decision-making		• Indigenous and tribal peoples have the right to “decide their own priorities for the process of development as it affects their lives, beliefs, institutions and spiritual well-being and the lands they occupy or otherwise use, and to exercise control over their economic, social and cultural development.” (Convention 169: Article 7)
	Healthy and safe work environment	Safe and clean working place	• Employers need to ensure that the machinery, processes, and any substances used at the workplace are reasonably safe and without risk to health. • Employers should also provide employees with protective clothing and equipment, emergency measures including first-aid, and training in health and safety norms; • Employees need to cooperate with their employers in maintaining a safe and healthy workplace; employers cannot force employees to work in an unsafe environment. (Convention 155: Article 16–19)

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
PRODUCTION CONSIDERATIONS	Fair wages and benefits to producers		• Both social factors (needs of workers and their families, cost of living/inflation, social security benefits) and economic factors (job creation, productivity, competitiveness) should be considered while setting the minimum wage. (Convention 131: Article 3) • Wages must be paid regularly, in full, and only in legal tender. (Convention 95) • Workers are obliged to perform only up to 56 hours per week; • Employers need to prominently display the start and end times for the workday or shift; • Overtime pay should not be less than 125% of the regular rate. (Convention 1: Articles 4–9) • Such compensation should be in addition to the remuneration paid for the same work performed during the daytime. Workers who have to perform work on weekly rest days or public holidays must be compensated for these days additional to the normal wage rates, for working on these days. (Convention 1: Article 8) • On completing a year of service, every worker should get paid leave of three working weeks each year. (Convention 132: Article 3)

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
PRODUCTION CONSIDERATIONS	Fair wages and benefits to producers		• At least 14 weeks of paid maternity leave. (Convention 183) • Workers should receive a sickness benefit, of 45% of the normal wage rate. (Convention 102)
	No child labor		• Any work which is likely to jeopardize children's health, safety or morals should not be done by anyone under the age of 18; or 16 under strict conditions. • Minimum age for basic work should not be lower than the "the age for finishing compulsory schooling," or 15 years, whichever is higher. • However, developing countries may initially set the lower minimum age of 14 years (12 years in case of light work). (Convention 138)
	No forced labor		• States must suppress use of forced labor: as a means of political coercion; for purposes of economic development; as a means of all types of discrimination; or as a punishment for participation in strike. (Convention 105: Article 1)
	Capacity building of producers		
	No discrimination		• Employers may not discriminate—exclude or show bias against—employees or potential employees on the

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
PRODUCTION CONSIDERATIONS			grounds of: race, color, sex, religion, political opinion, national extraction or social origin, age, HIV/AIDS status, disability, family/ marital status (family responsibilities), trade union membership and related activities in terms of employment and remuneration. (Conventions 87, 98, 100, 156, 158, 159, 162 and 183) • No discrimination against indigenous workers. (Convention 169: Article 20)
		Strive for gender equality	Occupational sex segregation is a form of discrimination. (Convention 111)
	Respect for human rights	Contract local workers	
		Create social opportunities	
DISTRIBUTION CONSIDERATIONS	Minimum distribution volume	Reduce transport/ storage volume	
		Make design foldable or stackable	
		Design knock down products	
	Minimum distribution weight	Reduce weight	
		Aim for rigidity by construction	
	Energy-efficient transport	Use energy efficient and clean transport	
	Localized production-to-consumption system	Contract local distributors	
	Minimum packaging	Reduce amount of packaging	
	Reusable packaging	Use reusable packaging	
	Recyclable packaging	Give packaging an extra function	
	Packaging made from reused/ recycled material	Use low impact materials	
		Use standardized bulk packaging	

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
CONSUMER-USE CONSIDERATIONS	Low/clean energy-consumption during usage	Use clean energy source	
		Reduce energy consumption	
	Reduced and clean consumables during use	Reduce or recycle consumables	
		Reduce water consumption	
	Safe for users health	Ensure safe usage	
		Avoid harmful substances	
	Customizable	Use modular design structure	
	User friendly		
	Affordable		
	Easily upgradeable	Design for upgradeability	
	Classic design	Strive for classic design	
	Promote a strong–user product relationship	Provide instructions to avoid misuse	
		Give usage a social value	
		Strengthen product–user relationship	
	Locally repairable and maintainable	Increase reliability and durability	
		Make maintenance and repair easy	
		Limit maintenance and repair	
		Use local maintenance and repair systems	

PRODUCTION-TO-CONSUMPTION SYSTEM	SUSTAINABILITY CHECKLIST	D4S RULES OF THUMB	ILO CONVENTIONS AND ARTICLES
END-OF-LIFE HANDLING CONSIDERATIONS	Mono-material	Reduce material complexity	
		Make it safe for composting	
		Avoid downcycling of materials	
	Designed for disassembly	Design for dismantling	
		Design for reuse	
		Avoid extra elements such as stickers	
		Use universal fasteners	
		Minimize the use of fasteners	
	End-of-life disassembly facilitates employment for local communities	Use existing take-back and recycling systems	
		Develop new take-back and recycling systems	
		Avoid incineration	

Figure 9.3: First version of the Sustainability Checklist developed with inputs from D4S and ILO (Reubens 2010)

The Sustainability Checklist illustrates a generic product's production-to-consumption system and the sustainable design parameters relevant at each stage, thus enabling the designer to better understand the interlinkages between the tenets of sustainability and production-to-consumption. The tenets of sustainability strongly influenced by each parameter are indicated, along with the potential of craft practice to address and be fortified by these parameters. By understanding the systemic perspective through the deconstructed parameters, the collaborative craft–design object can be strategized to be culturally, ecologically, socially, economically or holistically sustainable.

The checklist makes the innovator aware of the potential and desired criteria that can make a product more holistically sustainable at a product development stage.

STEP 5: COLLABORATIVE DESIGN PROCESS

As discussed in 3.5, the final design—and thereby, sustainability—is not shaped only by the designer, but by each of the different occupational groups and stakeholders across the supply chain (White et al, 2008). Designers need to collaborate with these groups and stakeholders in order to be able to go beyond design's typical manufacture–use focus (Dewulf, 2013), in order to view sustainability concerns and opportunities from across the production-to-consumption system (White et al, 2008). These diverse inputs from actors who are not traditionally part of the innovation team are even more important to enrich the innovation process, given that sustainability traditionally lies outside the expertise of designers, and that in-house experts (Aye, 2003) on sustainability are not generally available to designers, in most instances.

Step 5 therefore advocates creating platforms that allow for collaborative decision-making by encouraging and actively facilitating a constant linkage and interaction between designers and actors, facilitators and enablers of the production-to-consumption system.

STEP 6: PROVIDING TOOLS FOR SUSTAINABILITY DESIGN

As discussed in 3.5, in a study among designers, the interviewees cited the lack of appropriate tools as a barrier to sustainable design (Aye, 2003). Designers were not clear on how to use existing tools (Lofthouse, 2006), including those which provided insights on the process and outcomes of designing sustainably (White et al, 2008), and those which outlined issues related to sustainable design (Lofthouse, 2006).

Designers wanted easy-to-use tools (Lofthouse, 2006) that had accurate and accessible information (Aye, 2003; Davis, 2001; Hes, 2005), and which could support the entire design process—including front-end innovation, which is where sustainability design needs to begin (Walker, 1998). Designers also cited the need for tools that could quantify and measure sustainable design achievements and communicate them through different mechanisms, such as ratings, to help legitimize sustainability efforts as credentials (Hankinson & Breytenbach, 2012), and therefore make a case for investing in sustainability to clients.

Step 6 of the Rhizome Approach centers on the Sustainability Checklist introduced in Step 4 as a tool for front-end innovation. In Step 6, there is a 360-degree evaluation of the finished product against the checklist by three evaluators. The evaluators can include the producer, and two external evaluators for objectivity. Each evaluator can rank the product 1=low, 2=medium, and 3=high. The final grading for the product will be the triangulated mean of the three grades.

The three evaluations allow for investigator triangulation (Denzin, 1978) as a method of reducing the discrepancies between the three scorings. The final score gives designers the opportunity to reconsider aspects of their design, and develop a more sustainable iteration if needed. The gradings can be represented visually in several ways. One way could be through colors, where, for example, red can represent a low grading, yellow can represent a medium grading, and green can represent a high grading. These gradings can be reflected on a *sustainability landscape* which can consist of a matrix depicting the identified four tenets of sustainability. For example, low energy-consumption affects both ecological and economic tenets, so there will be one dot each in each of these *regions*. The final sustainability quotient can be reflected as a little *map* (Fig. 9.4) which will allow consumers to see at a glance what tenets of sustainability the product addresses the most and those tenets which are neglected.

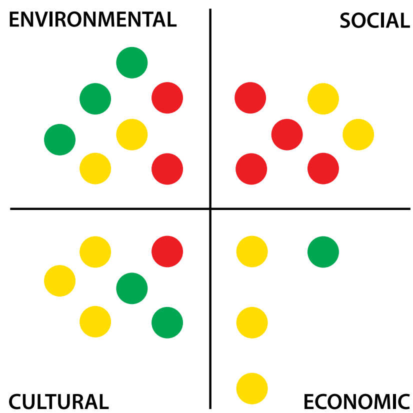

Figure 9.4: Sustainability Landscape, to represent results of assessment against the Sustainability Checklist (Reubens 2011)

The quantitative output of the checklist can be used to showcase the sustainability achieved, including through a branding and labeling initiative. Empirical research on the use of the checklist to assess and brand sustainability, and the rationale for the same, is offered in Chapter 11.

STEP 7: KEEPING THE DESIGN TEAM IN THE LOOP UNTIL FINAL PRODUCT ACTUALIZATION

As discussed in 3.5, designers do not feel responsible for the sustainability of the final product (van Hemel & Cramer, 2002) as they are not the sole actors in the innovation process. The final design is the result of several iterations by different functional groups—including design, production, marketing, and merchandizing (White et al, 2008). In the end, none of the functional groups takes ownership or accountability for the final design outcome, because they were not involved with design decisions before and after their iteration. If the sustainability function is to be under the purview of design, designers need to be in the loop and in the forefront of responsibility, right from the front-end stage through to final product actualization.

Step 7 therefore advocates keeping designers in the loop from the front-end stage to right up to final product actualization so they can maintain an overview of the process (White et al, 2008), and ownership of the design outcome.

9.3 SUMMARY AND CONCLUSIONS

This chapter presented the second output of the design-and-development phase of this design science research—a methodology called the Rhizome Approach. The approach was developed towards equipping designers to leverage craft production-to-consumption systems in developing countries for sustainability design in a holistic manner. Most sustainability design centers on the ecological tenet; the Rhizome Approach proposes a methodology which advocates and facilitates a holistic focus on all the four tenets of sustainability. The approach advocates the reemergence of systems thinking in the design process towards sustainability design, through collaborative innovation.

The seven steps of the Rhizome Approach correlate with the seven broad thematic barriers to sustainability identified in the literature review—i.e., lack of knowledge about sustainability; lack of holistic overview of production-to-consumption systems and value chains; failure to include sustainability at a strategic level in the overall approach; failure to include sustainability criteria in the design brief; absence of a collaborative design process; lack of tools; and failure to keep design teams in the loop during the product actualization process. The efficacy and relevance of the Rhizome Approach, step-wise and as a whole, was validated through a questionnaire that was e-mailed to 15 designers located around the world. Their feedback, especially vis-à-vis alternatives to each step of the approach is discussed in Chapter 12.

The Sustainability Checklist was further developed through a second phase of iterations. This phase was mindful of the fact that design's influence on sustainability is limited without support from the outside envelope, comprising the company, the market and policy. This aspect is discussed further in Chapter 11, which dwells on Research Question 3—What mechanisms would support and encourage the use and operationalization of any sustainability-design approach that might be developed in response to Research Question 2?

The following chapter discusses how the Rhizome Approach was demonstrated and tested in the context of the Kotwalia community, which was selected to represent the client class of our larger problem class.

10 THE BAMBOO SPACE-MAKING CRAFT WORKSHOP

The previous two chapters presented the first two of the three outputs from our design-and-development phase of research: a construct called the Rhizome Framework, and a methodology towards sustainability design called the Rhizome Approach. The final output of this phase of our design science research was an instantiation in the form of a workshop, which would demonstrate and trial the Rhizome Approach and the Rhizome Framework with the Kotwalia community and Indian designers, who represent the client class. This chapter dwells on the design of this workshop, and reports on the real-time workshop conducted in 2011.

An overview of the workshop is offered in 10.1. The next seven sections report on the design, actualization and findings of Steps 1–7 of the Rhizome Approach, vis-à-vis the workshop. The first part of each section discusses the workshop design, the next, how the design was actualized in the real instantiation, and the last, the findings from the four questionnaires (Annexures 1, 2, 3 and 4) administered to the design participants in the workshop relevant to that step. A detailed account of the workshop can be found in the publication titled Bamboo Craft: Space-Making Craft Workshop (Design Innovation and Craft Resource Center, 2013)—which was compiled and edited as an output of our documentation-and-dissemination phase—and on which this chapter draws.

Section 10.9 presents additional findings beyond the step-wise findings presented in Sections 10.2 through 10.8. The overall summary and conclusion of this empirical research are presented in 10.10. The validation of the findings from the workshop is presented in the following chapter, and the second iteration of the design-and-development phase of the Sustainability Checklist and the scheme to support its operationalization, will be presented in the Chapter 12.

10.1 THE BAMBOO SPACE-MAKING CRAFT WORKSHOP

The Bamboo Space-Making Craft Workshop was conducted in India to substantiate the workshop design which, in turn, aimed to demonstrate and test the Rhizome Framework and the Rhizome Approach. A version of the conceptual framework which includes the outputs of the design-and-development phase, which was trialed by the Bamboo Space-Making Craft Workshop, is offered in Fig. 10.1. The intervention is indicated by orange dotted lines and its perceived outcomes are indicated by green dotted lines. The space making-craft workshop was conducted in India, from January 20 to February 2, 2011, at the Design Innovation and Craft Resource Centre (DICRC), at CEPT (Centre for Environmental Planning and Technology) University, Ahmedabad.

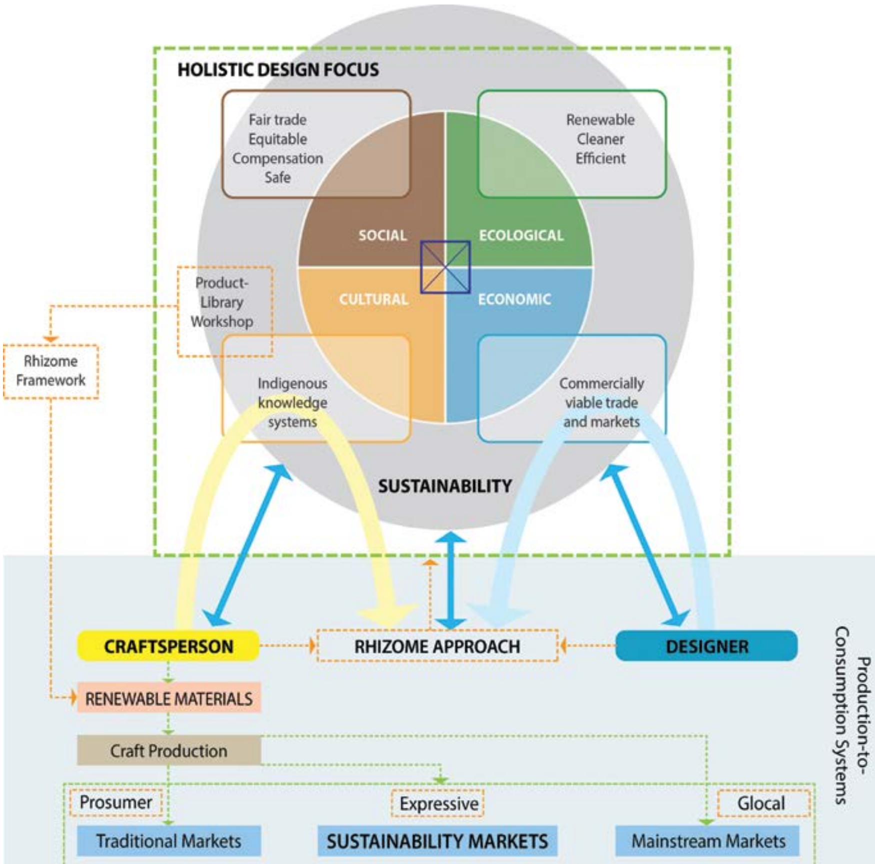

Figure 10.1: Conceptual framework with designed intervention (orange dotted lines) and perceived outcomes (green dotted lines) (Reubens 2015)

The overall workshop structure was based on a generic technical-training format, involving didactic learning, supervised hands-on training, and unsupervised experience (Baille & Ravich, 1993). The underlying effort was to provide a learning experience with relevance, reflexivity and continuity (Strand, 2011). An important part of the workshop design was to take the designers through three independent but closely interconnected modes of thinking: a) connective or systems thinking; b) critical thinking or the ability to critique existing and established mental models; and c) personal thinking, or self-awareness.

A key aspect of the design of the didactic-learning module was that it was brief, relevant, and established core concepts. Experiential learning through field visits was used to instill reflexivity: confronting the participants with sustainability's trade-offs, the interlinkage between different elements that form the systems picture, and the necessity to negotiate sustainability's complex terrain and be more holistic, were all part of this learning. Finally, the process of designing the product involved continuity of the earlier learning, but was largely unsupervised—though it involved inputs from different factions—and relied on personal thinking.

PARTICIPANTS AND FACILITATORS

The workshop was designed to include an equal number of designers and craftspeople as participants, in line with the emphasis on collaborative design and craft inputs towards sustainability design that is central to both the Rhizome Framework and the Rhizome Approach. The 24 design participants (Annexure 5) included design students from the Faculty of Design, CEPT University, Ahmedabad, and the Indian Institute of Craft and Design (IICD), Jaipur, in addition to professional designers and civil engineers. The 24 craft participants (Annexure 6) were Kotwalia bamboo-working trainees from Waghai town, who were linked to the Tapini Bamboo Development Centre (TBDC) and the Eklavya Foundation.

The facilitators (Annexure 7) included assistant professors from CEPT University and IICD, a resource person from the Eklavya Foundation, master-craftspeople/production heads from the TBDC and, representing both Delft University and our sustainability-design firm Rhizome, us.

STRUCTURE OF WORKSHOP

The day-by-day outline of the workshop is as under in Fig. 10.2.

DAY	ACTIVITY
1	• Presentation and discussion on linkages between sustainability, bamboo and design • Introduction to the Rhizome Framework • Viewing of the product range of the Kotwalia community, created through the product-library workshop (see 8.2)
2	• Field visits for exposure to stakeholders in the bamboo production-to-consumption chain, including Kotwalia craft enterprises and the forest department
3	
4	• Icebreaking exercises • Forming three groups as per the Rhizome Framework—expressive, glocal and prosumer • Design brief and introduction to the Sustainability Checklist • Subgroup-wise brainstorming session for the entire design team and the entire craft team to come up with potential applications and design directions in line with their respective subgroup. The groups presented their findings to the remaining groups, and also to varied stakeholders following the discussion on Day 3
5	• Concept development by designer–craftsperson teams
6–12	• Design and prototyping
13	• Evaluation against the Sustainability Checklist
14	• Exhibition in Ahmedabad

Figure 10.2: Day-by-day outline of workshop

OVERVIEW

An overview of the workshop vis-à-vis the Rhizome Approach is offered in Fig. 10. 3 below:

STEP	BARRIER	AIM	METHOD	WORKSHOP-SPECIFIC MECHANISMS
1	Lack of knowledge about sustainability	Inform designers about sustainability, and the connections between its tenets	Didactic knowledge through knowledge kit to provide information and knowledge on the core concepts on sustainability	• Knowledge kit containing pre-workshop reading material • Presentation by institutional representatives • Our presentation on the holistic picture of sustainability

2	Lack of a holistic overview of the production-to-consumption system	Sensitize designers to the systemic production-to-consumption system	Experiential learning through exposure visits to different nodes of the production-to-consumption system	• Exposure visits to:
				  • Handicraft-scale MSMEs
				  • Design-led MSME enterprise
				  • Industrial-scale enterprise
				  • Bamboo resource-growing area

3	Failure to include sustainability at a strategic level in the overall approach	Factor sustainability into the strategic blueprint	Internalization through classroom experiential learning to introduce sustainability into the blueprint	• Sharing and explaining Rhizome Framework as a common goal
				• Concept mapping exercises on
				  • Is craft relevant?
				  • What is the impact on each direction of the Rhizome Framework on the tenets of sustainability?
				  • What are the product possibilities of each direction of the Rhizome Framework?

4	Failure to include sustainability criteria in the design brief	Articulate sustainability criteria in the design brief	Clear brief supplemented by the Sustainability Checklist to clarify desired design decisions and their impact on each tenet of sustainability	• Clear brief to design a commercially-viable bamboo product, using local production capacities, that leverages indigenous knowledge systems • Clear outline of which direction of the Rhizome Framework on which the design would center • Explanation of the Sustainability Checklist and provision of a copy to each innovation team

STEP	BARRIER	AIM	METHOD	WORKSHOP-SPECIFIC MECHANISMS

5	Lack of a collaborative design process	Provide inputs from different stakeholders towards a collaborative design process	Constant linkage and interaction with stakeholders of the production-to-consumption system to facilitate collaborative design	• Icebreaking, team-building and energizing exercises
				  • Animal-sounds exercise
				  • Three-secrets exercise
				  • Hand-drawing exercise
				• Constant feedback from experts and stakeholders
				  • 11 talks from different resource experts
				  • Constant feedback from facilitators in their area of expertise

6	Lack of tools to measure holistic sustainability against indicators	Increase designers' accountability to factor sustainability into their designs and provide a tool to measure the sustainability achieved	Evaluation of the design against the Sustainability Checklist by three evaluators	• Self-evaluation by designers using the Sustainability Checklist • Cross-validation of evaluation by one community expert and one design expert
7	Failure to keep the design team in the loop during product actualization	Keep designers in the loop until final product actualization	Involving design team in all iterations of the design, up to final product actualization	• Involvement of designers in all changes required for product actualization until final prototype is resolved

Figure 10.3: Overview of bamboo space-making workshop vis-à-vis the Rhizome Approach

Each of these seven steps is discussed in detail in the following seven sections. The first part of each section discusses the workshop design, the next, how the design was actualized in the real instantiation, and the last, the findings from the questionnaires administered, relevant to that step.

STEP1

10.2 INFORM DESIGNERS ABOUT SUSTAINABILITY, AND THE CONNECTIONS BETWEEN ITS TENETS

Step 1 of the Rhizome Approach advocates bridging the information and knowledge gap on sustainability. This is actualized by orienting the participants on core concepts, including the connections between sustainability, design, material and technology, and production-to-consumption systems.

DESIGN

The workshop design included multiple learning methods, including a combination of didactic and experiential learning, to inform the designers about sustainability. Multiple learning methods were decided upon to better expose participants to concepts—including craft, sustainability and sustainability design—which their mainstream design education may not have covered adequately. In order to better structure this chapter, the experiential learning component of the workshop is elaborated upon in Step 2, covered in Section 10.2. This section covers the didactic-learning phase, aimed at the brief delivery of factual information in order to set the tone for learning and to ensure that core concepts are covered (Domask, 2007). We used digital presentations followed by discussions, and supplemented by a knowledge kit comprising focused reading material for this (Baille & Ravich, 1993). This didactic learning is critical to ensuring that seminal and core concepts are covered, thus providing the foundation for the participants' overall sustainability learning and holistic internalization.

ACTUALIZATION

Given that sustainability is a vast and complex domain, it is very important to impart sustainability information that is relevant and applicable in design practice (Strand, 2011), in order to optimize time and avoid information overload. As discussed earlier, designers do not want tedious or lengthy sources of information which are difficult to absorb. Therefore, information closely related to the overall domain of the specific design project was selected.

Reading Material

Before the workshop, the designers were provided with a knowledge kit, which they could use for reference and study. This kit comprised reading material produced during the documentation-and-dissemination phase of our research, as listed below:

• INBAR Technical Paper 60, titled, *Bamboo in Sustainable Contemporary Design* (Reubens, 2010b), which discusses the linkages between bamboo, sustainability and design

• Article from the *Journal of Craft Research*, titled, Bamboo Canopy: Creating New Reference Points for the Craft of the Kotwalia Community in India Through Sustainability (Reubens, 2010a), which discusses the Rhizome Framework against the background of the Kotwalia community

• Diagnostic study report for development of the bamboo craft cluster in Tapi district under the participatory cluster development program of NABARD (National Bank for Agriculture and Rural Development) (Reubens, 2010c), which discusses the bamboo production-to-consumption system, especially vis-à-vis the Kotwalia community

Digital Presentations

The didactic learning phase included digital presentations followed by interactive discussions, as listed below:

• Orientation sessions by the institutions involved—DICRC, IICD, the Eklavya Foundation, TBDC, Rhizome, and Delft University of Technology. These presentations brought out the synergies between the mandates of the institutions, and the different institutional perspectives on sustainability.

• We gave a presentation on the concept of sustainability—discussing how it is an evolving and holistic concept.

Apart from the presentations listed above, different expert resource persons gave presentations every morning through the course of the workshop. While these also comprise the didactic learning module, for reasons of structuring this chapter, they are discussed in 10.6.

FINDINGS

Digital Presentations

Most of the participants found the presentations, *Sustainability and the Rhizome Approach*, and *Introduction to DICRC and Space-Making Crafts* to be the most useful in Step 1. The remaining found the introductory presentation titled, *Introduction to IICD and Craft Tradition and Culture*, to be most useful.

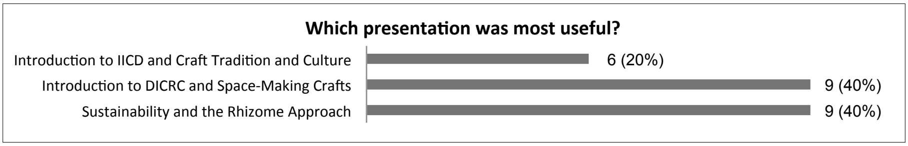

Figure 10.4: Findings from 24 respondents on the most useful presentation

STEP2

10.3 SENSITIZE DESIGNERS TO THE SYSTEMIC PRODUCTION-TO-CONSUMPTION SYSTEM

Step 2 of the Rhizome Approach advocates sensitizing designers to the systemic production-to-consumption system, including through exposure visits to different nodes of the value chain and stakeholders of the production-to-consumption chain.

DESIGN

The exposure visits were an important part of the experiential-learning component of the workshop design, which included both major categories of experiential learning—field-based and classroom-based (Schwartz, n.d.). This section dwells on field-based learning, which is the oldest and most established form of experiential learning. The classroom-based experiential learning modules are discussed in the following sections.

The field-based experiential-learning module built upon the didactic learning inputs of Step 1, where the participants were introduced to seminal concepts around sustainability. The exposure visits were intended to expose participants to real-world issues, which they could connect back to the theoretical inputs of Step 2. The exposure visits would offer participants the opportunity to ground-truth for themselves the inputs on sustainability-related issues, actors and dynamics, which they were exposed to through the didactic learning of Step 1 (Alvarez & Rogers, 2006).

The exposure visits were intended to give the participants a real-world experience of cause and effect. Often, the impact of policy and other decision-formulating mechanisms is felt deeply at a local level. Exposure visits would help the participants to connect the global theory and dynamics—to which they were exposed in Step 1—with the local impacts on people located thousands of miles away from the decision-makers (Domask, 2007)—which they experienced in Step 2. This realization would enable designers to internalize the extent of the impact their design decisions could have, and the fact that these may be relatively *invisible*, but felt very deeply by a specific group.

The exposure visit to the different nodes of the production-to-consumption system was aimed at enabling the participants to internalize a "systemic perspective of the world" (de Déa Roglio & Light, 2009, p. 158), and understand how the smaller subset of each production-to-consumption system fits within this. To be able to engage with the world as a systemic construct that they could address through sustainability design, the participants needed to identify and internalize "the sets of interrelationships and process of change, with a focus on and a concern for sustainable development" (de Déa Roglio & Light, 2009, p. 158). Also important was the ability to identify the interconnections between different elements that constitute a problem context, and their influences on different spheres—including society, culture, economy and ecology (de Déa Roglio & Light, 2009). This, in turn, would help them to go beyond a myopic, short-term, and business-centric perspective (Atwater & Stephens, 2008; Ghoshal, 2008; Strand, 2011)—and beyond design's typical manufacture–use focus.

ACTUALIZATION

The field-based experiential learning module involved an intensive exposure visit to Waghai, a town in South Gujarat located an overnight journey away from Ahmedabad. The participants and facilitators stayed at the Kilad Nature Education Campsite—an ecotourism facility run by the Forest Department of Gujarat—which was the base for capsule exposure visits. Participants had discussions with the different actors, enablers and supporters of the nodes of the production-to-consumption system they visited. Sharing of experiences through informal and formal discussions, and interacting with stakeholders and actors in different set-ups, allowed the designers to internalize the potential for realizing sustainability through a paradigm shift in the production set-up, including production volume, livelihood opportunities, preservation of the social and cultural nucleus, and the use of materials (Walker, 1998).

The capsule exposure visits are as under:

- KOTWALIA VILLAGE (HANDICRAFT-SCALE MSMES): The participants were divided into three groups, each of which visited a different Kotwalia village. The groups observed and documented the day-to-day life of Kotwalia families in order to internalize a handicraft-scale bamboo production-to-consumption system. Each group was accompanied by a facilitator and an interpreter, to enable the participants to interview and converse with the families. Several of the participants tried their hand at bamboo-working.

- TBDC-EKLAVYA-RHIZOME PRODUCTION UNIT (DESIGN-LED MSME-SCALE ENTERPRISE): All of the participants visited the production unit of the TBDC-Eklavya-Rhizome consortium, where bamboo products are handcrafted for contemporary markets. The participants had a chance to see the impact of training and use of power tools and design on the productivity and product-range of the same Kotwalia community in an MSME-scale production-to-consumption system. The participants interviewed and discussed with resource people—including the producers, production managers and community mobilizers—from the unit.

- VANIL UDHYOG (INDUSTRIAL SCALE): All of the participants visited Vanil Udhyog, an integrated wood-working unit established by the Gujarat State Forest Development Corporation. The unit has state-of-the-art equipment—including conventional and solar-seasoning plants, saw-mill and finishing departments. The participants observed how more than a hundred tribal workers worked under the supervision of qualified engineers to manufacture ISO-compliant products in an industrial-scale production-to-consumption system.

• WAGHAI BOTANICAL GARDEN (RESOURCE-GROWING AREA): The participants saw different bamboo species of different ages at the Waghai Botanical Garden and biodiversity conservation center. This gave them the opportunity to understand the morphology of bamboo discussed during the presentation in Step 1. We gave a short talk, which provided inputs on field-identification of bamboo species, and the bamboo plant's morphological characteristics.

FINDINGS

A questionnaire was administered to the participants on their return to check their level of learning on the Kotwalia bamboo production-to-consumption system. The aim of this was to ascertain the efficacy of the design and actualization of Step 2.

Level of learning on raw-material source

A majority of the participants could correctly answer that the forest is the primary source of bamboo for the Kotwalia community. The remaining wrongly cited subsidiary sources as the primary source.

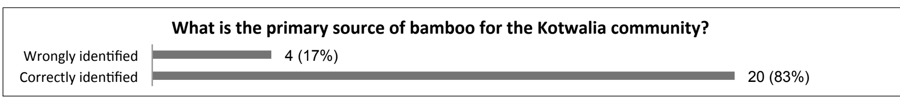

Figure 10.5: Findings from 24 respondents on primary source of bamboo for the Kotwalia community

Level of learning on raw-material availability

All of the participants correctly assessed the availability of bamboo to be between adequate and low, showing a satisfactory level of awareness on resource availability following the field visit.

Level of learning on raw-material transportation

None of the participants could correctly assess all three ways in which the Kotwalia community transports bamboo—themselves, through private transporters and through the government. While a majority of participants correctly assessed the one major way that the Kotwalia community transports bamboo—themselves—only a few could identify two ways of transportation; and some wrongly answered that members of the Kotwalia community do not transport bamboo themselves.

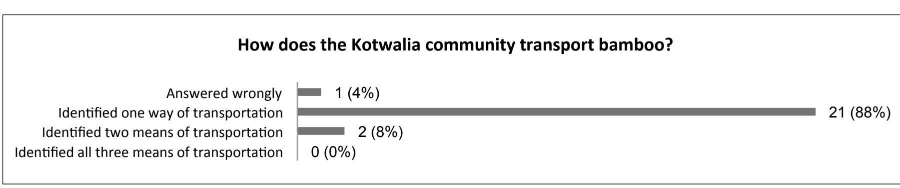

Figure 10.6: Findings from 24 respondents on raw-material transportation of the Kotwalia community

Level of learning on design and innovation

More than four-fifths of participants correctly assessed that open-source craft tradition and inputs from traditional users/patrons are the primary source of design and innovation for products produced by the Kotwalia community. Of these, over half answered open-source/traditional craft tradition, and the rest answered traditional patrons.

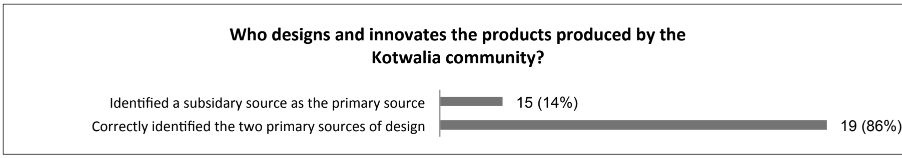

Figure 10.7: Findings from 24 respondents on design and innovation of products crafted by the Kotwalia community

Level of learning on processors

More than half of the participants correctly answered that all three constituents of a Kotwalia family—men, women and children—are involved in bamboo craft. The rest cited only men, or only men and women, as being involved.

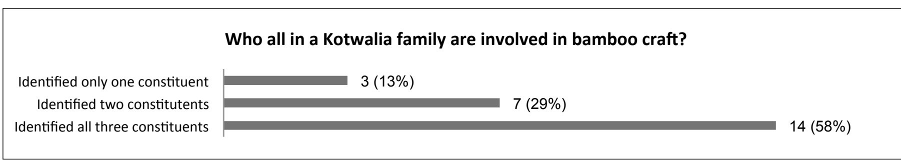

Figure 10.8: Findings from 24 respondents on involvement of family in processing

Level of learning on treatments

A little more than half of the participants could correctly identify the two traditional methods of bamboo treatment—smoking and water soaking; the rest could identify only one of the two methods, and one wrongly identified painting as a traditional method of bamboo treatment.

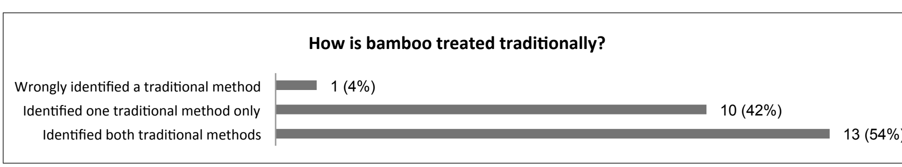

Figure 10.9: Findings from 24 respondents on traditional treatment methods of bamboo

Level of learning on type of bamboo used

A little over two-thirds of the participants could correctly answer that the craftspeople use green bamboo for traditional products.

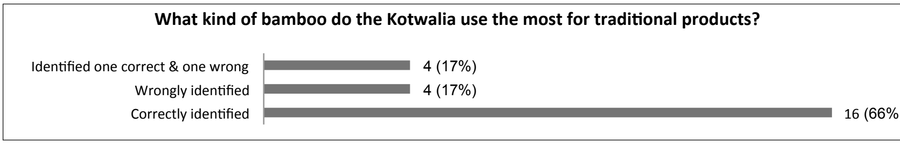

Figure 10.10: Findings from 24 respondents on type of bamboo used for traditional products

Level of learning on transfer of craft knowledge

A majority of the participants could correctly identify only one way in which the Kotwalia learn craft—inter-generationally or through training.

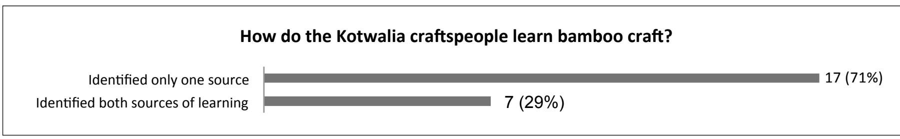

Figure 10.11: Findings from 24 respondents on transfer of craft knowledge

Level of learning on status of craft practice

A majority of all participants could correctly answer that the quantum of Kotwalia craftspeople doing bamboo craft had reduced compared to in the past; the remaining gave the wrong answer. Of the two respondents who didn't go to the field visit, one could not answer at all.

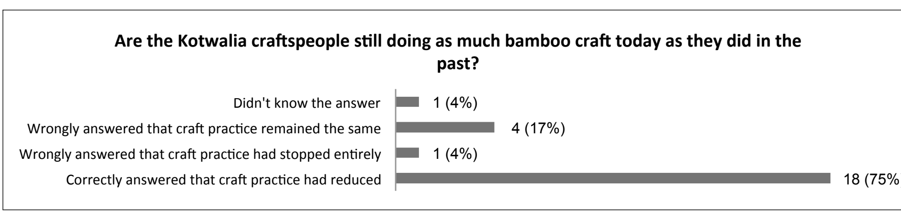

Figure 10.12: Findings from 24 respondents on the status of craft practice

Level of learning on marketing

Only a few of the participants could correctly identify all four ways in which the Kotwalia sold their products—within the village, at nearby villages, at towns and at tourist places. The remaining could identify between one to three ways of how the Kotwalia sold their products. The one respondent who didn't do the field visit didn't know the answer at all.

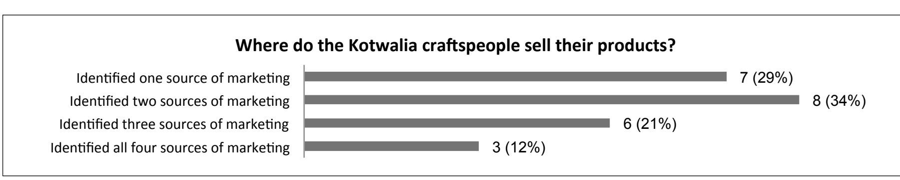

Figure 10.13: Findings from 24 respondents on the marketing of traditional products

The overall analysis of the findings, depicted in Fig. 10.14 below seems to indicate that the participants were able to grasp the design perspective the best, perhaps as they were from a design background. The most wrong answers were related to the resource, probably because the participants did not see resource-related practices like harvesting or transportation first-hand.

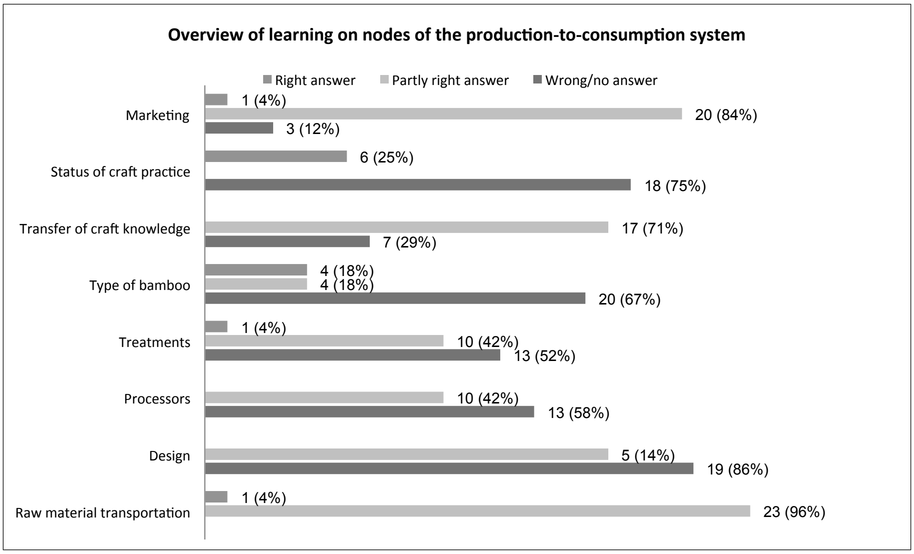

Figure 10.14: Overview of learning on different nodes of the production-to-consumption system. The 24 participants are assessed separately for each item

OVERALL PARTICIPANT EXPERIENCE

Two of the participants were not able to go on the field exposure visit. Both of these participants could not answer several questions on the craft production-to-consumption system, despite having access to the knowledge kit in Step 1, which contains all of this information. All of the participants who visited the Kotwalia community felt that they were better able to understand the production-to-consumption value chain more clearly and thoroughly, after the visit.

All of the participants answered that they thought that there are differences between industrial and non-industrial, or craft, set-ups in terms of production, design requirements and potential; and that the exposure visit had helped them understand the difference.

STEP3

10.4 FACTOR SUSTAINABILITY INTO THE STRATEGIC BLUEPRINT

Step 3 of the Rhizome Approach advocates factoring sustainability into the strategic blueprint, towards which all of the actors of the collaborative-design process will work collectively.

DESIGN

Step 3 centers on sharing the Rhizome Framework with the participants, and facilitating their internalization of the holistic sustainability ethos that underpins it, through application and reflection. This is done through classroom exercises that require the participants to apply the learning from their primary experiences of Step 2—the field and exposure visits—thereby leading them to reflect upon them. Classroom exercises which require students to apply learning from their primary experiences work at three levels: first, they prevent participants from forgetting the learning from primary experiences; second, the need to reflect upon and apply the learning from the primary experiences bolsters the primary experiences and learning from them; and third, the very act of reflection generates secondary experiences (Wurdinger, 2005).

The exercises used in the workshop were shortlisted and/or designed based on a study of existing adult classroom-based experimental learning modules, mechanism and strategies—including games, role play, simulations, case studies, presentations and group work (Schwartz, n.d.). The underlying aim of these exercises was to pose problems whose resolution would require participants to think and to do, thereby facilitating reflection, internalization and retention of the consequent learning—as opposed to requiring participants to remember information by rote (Wurdinger, 2005). The exercises are aimed at facilitating critical thinking—the ability to become aware and question tacit mental models which guide decision-making as an individual and/or a group (de Déa Roglio & Light, 2009).

The exercises were designed keeping in mind Moon's (2004) methods, including:
- **Concept maps:** These reveal the participants' perception; sharing the maps allows for exchange between participants' perceptions
- **Asking participants to explain and apply:** This leads participants to deeper critical thinking and reflection
- **Questioning:** Posing open and leading questions, especially when set as problems, encourages critical thinking and reflection

ACTUALIZATION

Returning to Ahmedabad, we presented the Rhizome Framework to both design and craft participants. This was followed by an interactive discussion, after which the craft and design participants were randomly divided into three groups—namely, *expressive*, *glocal* and *prosumer*—in line with the design directions of the Rhizome Framework.

Each group was given the following exercises:
• **Is craft relevant to sustainability design?** The participants of each group were asked to address this question through concept maps.
• **Systems thinking on the impact of their direction of the Rhizome Framework on the tenets of sustainability:** The participants of each group were asked to address this question through concept maps. Each group was then asked to consider the positive and negative impact of its direction on the production-to-consumption system; from the social, ecological, cultural and economic perspectives. This exercise was designed to enable to participants to critically reflect on the systemic outcome of the directions of the Rhizome Framework.
• **What are the product possibilities for each direction?:** The participants and craftspeople of each group were asked to address this question through concept maps, and present the results pictorially, using keywords where required.

All of these questions were formulated in line with Moon's (2004) methods of posing simple, open, and leading questions which would stimulate thought and reflection. The groups were asked to follow generic concept-mapping methodology (Saroyan & Amundsen, 2004) to answer these questions.

This included:
a) Brainstorming Phase: Participants were asked to brainstorm individually, and list the emerging facts, terms and ideas succinctly on separate adhesive notes. The relationships, relative importance, or redundancy were unimportant; the focus was on creating a comprehensive list.
b) Organizing Phase: Participants were asked to collectively organize all the adhesive notes on a large sheet of paper to create logical groups and subgroups. Some concepts were plotted in multiple groupings.
c) Layout Phase: Participants were asked to collectively arrange the groupings on a sheet of paper in a manner which represented their understanding of priority and interrelationships between the concept groups. Related concept groups were placed next to each other, while more important or meta-concepts were placed above subconcepts.
d) Linking Phase: Participants were asked to draw arrows to depict the relationships between connected items. Where relevant, the relationship was elaborated upon with a keyword or short phrase.
e) Finalizing the Concept Map: Participants worked on the graphic representation of the concept map in order to make it more presentable and easily understandable.

The output of each exercise was shared with the designers and craftspeople, and through interactive sessions. The last exercise, which involved both designers and craftspeople, was designed to enable both factions to see the difference and similarities in their team-members' perceptions, and to learn, bridge and realign their own perceptions where relevant.

FINDINGS

Relevance of Rhizome Framework

As one participant was absent, the total number of respondents for this phase was 23. A majority of these participants found the directions developed through the Rhizome framework relevant for craft evolution; the others were not sure, and one participant did not find them relevant.

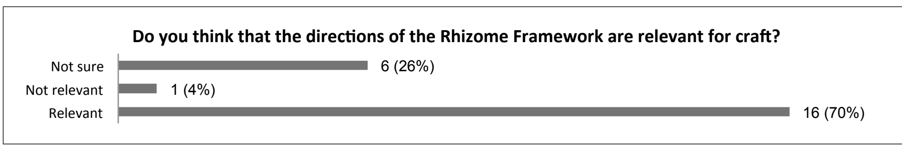

Figure 10.15: Findings from 23 respondents on the relevance of the Rhizome Framework

Product-library workshop

A majority of participants found the product-library somewhat helpful, the remaining found it very helpful and one participant found it barely helpful in understanding the basic level of products and skill available within the craft practice.

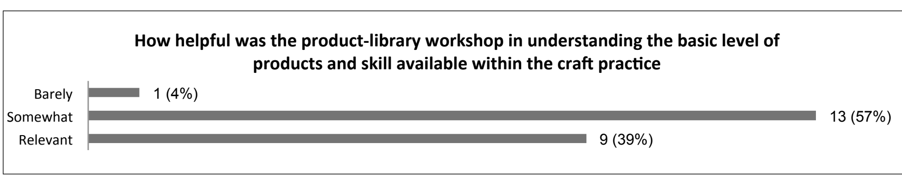

Figure 10.16: Findings from 23 respondents on the efficacy of the product-library workshop

Systems brainstorming exercise

A majority of participants found the brainstorming exercise regarding the systemic effect of their direction very helpful to see the larger picture at a strategic level, the remaining found it somewhat helpful and one participant found it barely helpful.

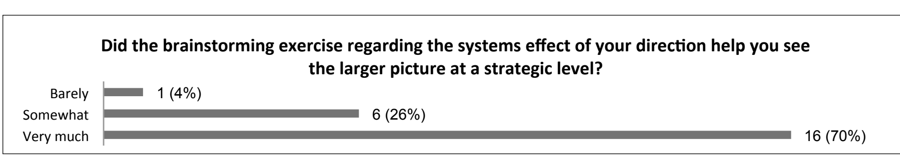

Figure 10.17: Findings from 23 respondents on the efficacy of the systems brainstorming exercise

Designers' group brainstorming exercise

A majority of participants found the designers' brainstorming exercise very helpful in seeing new product possibilities that they would not have considered on their own; the remaining found it somewhat helpful and one participant found it barely helpful.

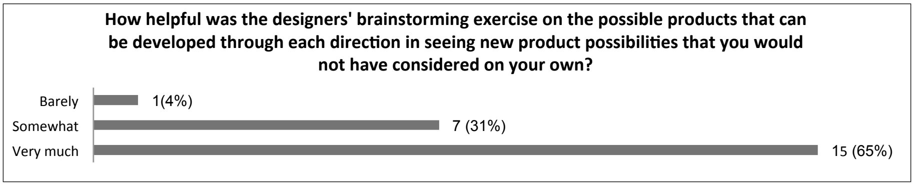

Figure 10.18: Findings from 24 respondents on the efficacy of the designers' brainstorming exercise

Craftspeople's group brainstorming exercise

Sixteen out of 23 participants found the craftspersons' brainstorming exercise helpful in seeing new product possibilities that they would not have considered on their own. However, for six persons the exercise was barely or not helpful.

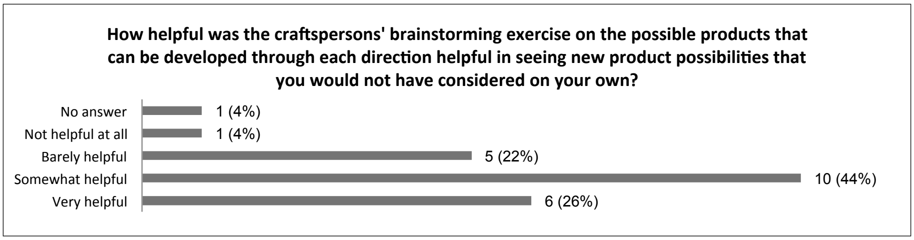

Figure 10.19: Findings from 23 respondents on the efficacy of the craftspeople's brainstorming exercise

The factor which was most unexpected by the designers with regards to the craftspersons brainstorming exercise was the level of creativity. The output of the craftspeople's brainstorming exercise was also more in touch with the market than the designers expected.

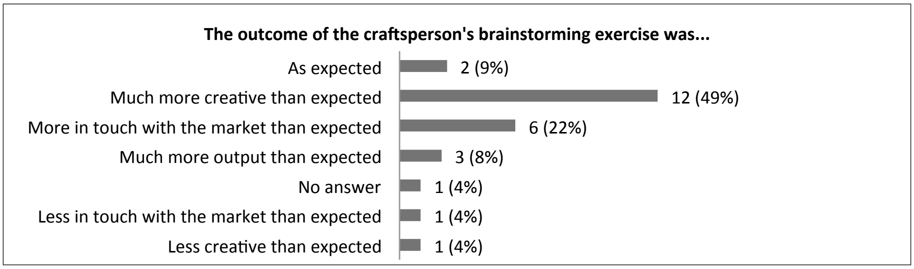

Figure 10.20: Findings from 23 respondents on the outcome of the craftspeople's brainstorming exercise; respondents could select more than one alternative.

STEP3

Most helpful exercise which helped in working towards one strategic goal

Twenty one of the 23 participants answered this question. A majority of those who answered identified the brainstorming session about the systems impact of each direction exercise as being the most helpful in working jointly towards one strategic goal.

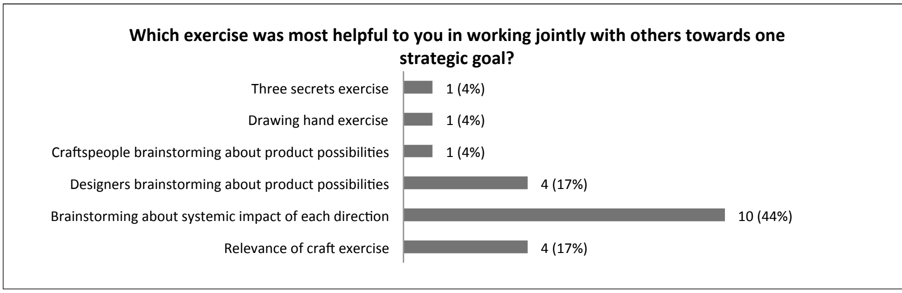

Figure 10.21: Findings from 21 respondents on the most helpful exercise when working towards a strategic goal; participants could mention more than one exercise.

STEP3

STEP4

10.5 ARTICULATE SUSTAINABILITY CRITERIA IN THE DESIGN BRIEF

Step 4 of the Rhizome Approach advocates articulating sustainability criteria in the design brief so that it can be factored into the front-end innovation phase.

DESIGN

Most traditional design briefs, in both design education and practice, require designers to follow linear problem-solving approaches that do not go beyond a product focus. In order to look at possible alternative solutions—including the design of strategies, systems and services—towards sustainability (Brass & Mazarella, 2015), there is a need for design briefs that concretely state and include the elements that designers are expected to shape through sustainability design—new visions and strategy for sustainability for a cross section of stakeholders (Brass & Mazarella, 2015). It is imperative that design briefs aiming for sustainability are reframed to address a holistic vision of sustainability which includes all of its dimensions—including the ecology, economy, society and culture (Walker, 2011).

Step 4 therefore focuses on providing designers with a clear brief vis-à-vis sustainability. The brief is supplemented by the Sustainability Checklist—developed during our design science research process—to clarify desired decisions and their impact on each tenet of sustainability. The checklist aims to help traditional *T-shaped designers* (Guest, 1991) with broad skill-set bases and single-domain specializations, to transition to being *O-shaped* (Brass, 2014) sustainability designers with systemic and panoptic orientations. Chapters 9 and 11 discuss in detail the first and second iterations of the checklist, respectively.

ACTUALIZATION

Clear Design Brief

The participants in the workshop were provided with a design brief which clearly indicated expectations vis-à-vis each dimension of sustainability. The design brief was: to design a commercially-viable (economically sustainable) product made from mature, sustainably harvested bamboo (ecologically sustainable), using local production capacities (socially sustainable) that leverage indigenous knowledge systems (culturally sustainable).

In addition, each group—*expressive*, *glocal* and *prosumer*—was briefed on which direction of the Rhizome Framework their design direction would center, and what this entailed.

Sustainability Checklist

In order to provide clearly stated expectations from the designers (Wurdinger, 2005), and to supplement the brief, the first iteration of the Sustainability Checklist (discussed in detail in 9.2) was shared with the participants. Each point of the checklist was discussed with the design participants in an interactive session involving the facilitators. Each innovation team was also provided with a copy of the checklist for their reference and use during the design process.

FINDINGS

Sustainability Checklist

A majority of participants found the checklist very useful in understanding the different sustainability concerns and factors at each stage of the product life cycle.

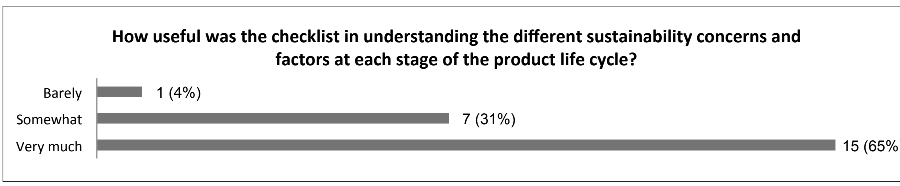

Figure 10.22: Findings from 23 respondents on the efficacy of Sustainability Checklist in helping understand different sustainability concerns and factors over product life cycle

Almost half of the participants came to know of a lot of new factors relating to sustainability as compared to what they knew of earlier through the checklist; while a little over half came to know of a few factors.

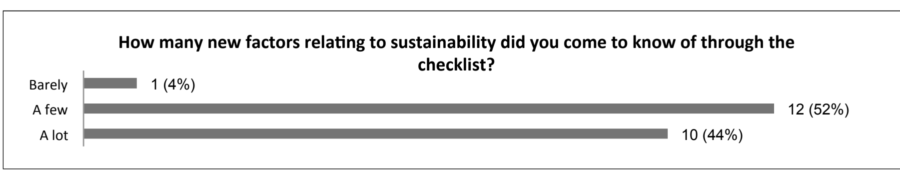

Figure 10.23: Findings from 23 respondents on the efficacy of Sustainability Checklist in helping know about new sustainability-related factors

Only a few participants could clearly understand the checklist just by reading it. A majority of participants could understand the checklist after each factor was explained to them. A few needed just a few factors explained to them after they read it.

STEP4

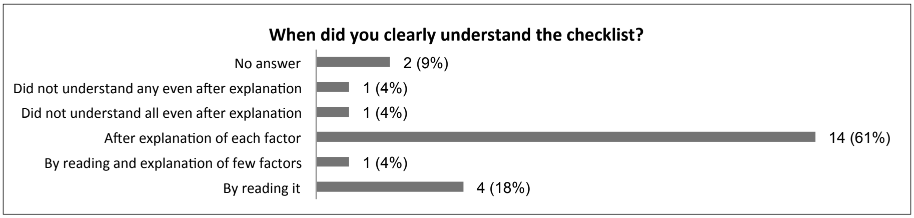

Figure 10.24: Findings from 23 respondents on the understandability of Sustainability Checklist

A majority of the participants felt a small booklet explaining each factor of the checklist would be very helpful to understand it better, while the remaining felt it would be somewhat helpful.

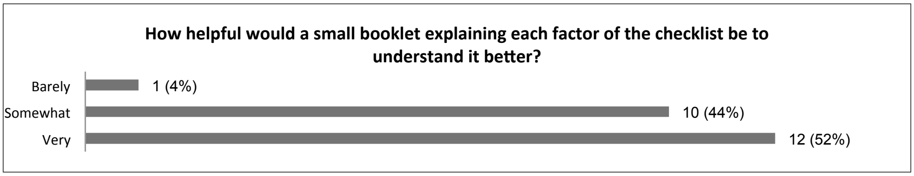

Figure 10.25: Findings from 23 respondents on whether the Sustainability Checklist should be accompanied by an explanatory booklet

A majority of participants referred somewhat to the checklist while designing their products. Because the use of it was below our expectations, the participants were also asked to mention the most important factor that would make them use the checklist.

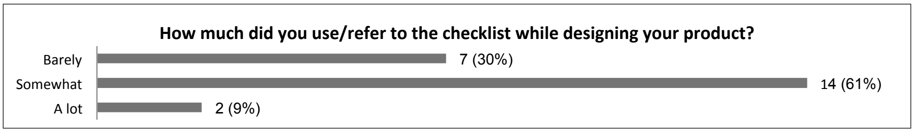

Figure 10.26: Findings from 23 respondents on how much they used the Sustainability Checklist in their design process

Seventeen of the 23 respondents replied to this question, answering that the No. 1 factor cited which would make them more likely to use the checklist was more time to design. The second-most popular factor was the checklist being explained through an accompanying booklet to make each point clearer.

STEP4

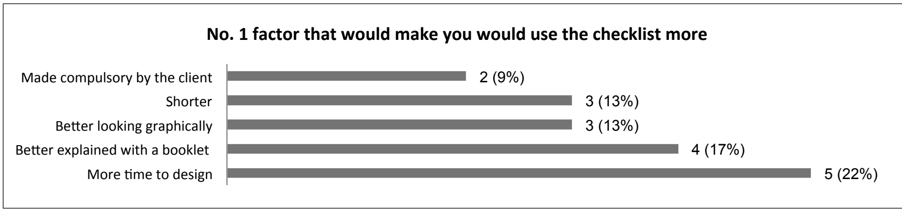

Figure 10.27: Findings from 23 respondents on the No. 1 factor that would make them use the Sustainability Checklist more

A majority of the participants said they would use the checklist a lot or somewhat when practicing sustainable design in the future.

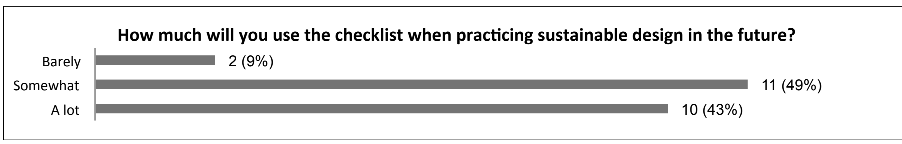

Figure 10.28: Findings from 23 respondents on how much they would use the checklist in the future

STEP4

STEP5

10.6 COLLABORATIVE INNOVATION

Step 5 of the Rhizome Approach advocates a collaborative design process, informed by inputs from different stakeholders of the production-to-consumption system and value chain. As discussed in Chapter 9, there is a need to bridge diverse actors within the organization, to facilitate transitioning from a pipeline design sequence to an integrative and inclusive design process (White et al, 2008).

DESIGN

Step 5 addresses the need for communication, collaborative decision-making and participatory design; by encouraging and actively facilitating a constant linkage and interaction between the actors, facilitators and enablers of the value chain. The designer is positioned as the facilitator of such a participatory design process, coordinating and collaborating with and between networks of stakeholders, towards future sustainability scenarios (Brass & Mazarella, 2015). In order to funnel such inputs to the innovation function, the workshop design included didactic and hands-on inputs. The didactic inputs included presentations by several experts, each of whom offered a different perspective on the production-to-consumption system. Apart from the experts, the facilitators provided hands-on inputs and feedback to the participants through the workshop.

Alongside these, inputs from the craftsperson have much to bring to the innovation function. The craftsperson has a great deal to contribute in design based on non-industrial materials and, in this sense, functions as a *barefoot engineer* (Barefoot College, 2016) for the designer. The designer–craftsperson equation is therefore of utmost importance, and needs to be developed and nurtured. This was done through exercises aimed at icebreaking (to help the team members to get to know one other), team-building (to aid people in forming bonds), and energizing (to facilitate group energy and to liven up a group) (Sixth College, n.d.).

ACTUALIZATION

Icebreaking, Team-Building and Energizing Exercises

Three exercises aimed at icebreaking, team-building and energizing were conducted towards facilitating collaborative design during the workshop. These exercises were aimed at helping the designer–craftsperson teams reach a comfort level that would make it easier to communicate and collaborate. The exercises used were the animal-couples exercise, the three-secrets exercise and hand-drawing exercise. The details of the exercises can be found in Annexure 8.

Expert Presentations

Following the exercises described above, the workshop design facilitated inputs from several experts from different nodes of the production-to-consumption system, so that different concerns were represented and could be addressed during innovation. These didactic inputs were in the form of digital presentations, followed by informal discussions that enabled the participants to interact with the speakers. The multiple perspectives on the same issue gave the participants food for thought. Several participants began to formulate and discuss their own constructs of concepts like sustainability, craft, space-making elements and development. In addition to the experts, the facilitators provided hands-on inputs in their area of expertise to the participants throughout the workshop.

FINDINGS

Icebreaking, Team-Building and Energizing Exercises

A majority of participants found icebreaking exercises very or somewhat helpful in enabling them to work with their craftsperson as a team towards one strategic goal.

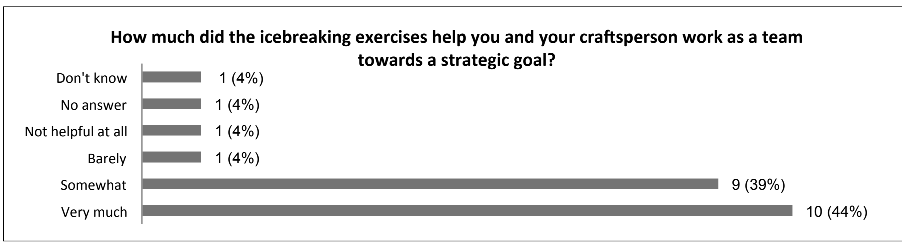

Figure 10.29: Findings from 23 respondents on the efficacy of the icebreaking exercises

The least favorite exercise was the hand-drawing exercise while 'finding partner' and three secrets were equally preferred.

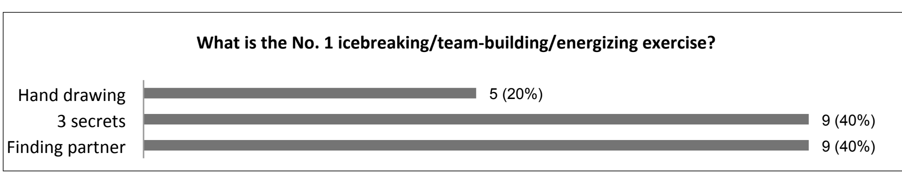

Figure 10.30: Findings from 23 respondents on the No.1 exercise

A majority of participants were somewhat surprised by the three things they found out about their craftsperson partner during the three-secrets exercise.

STEP5

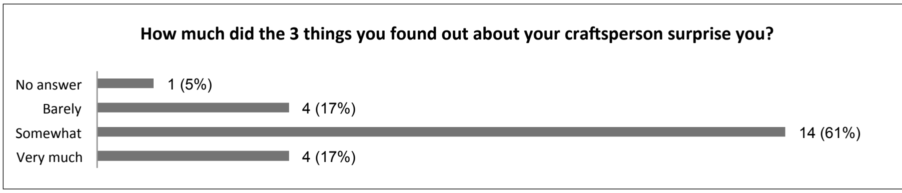

Figure 10.31: Findings from 23 respondents on whether they were surprised at the three things they found out about their craftsperson partner during the three-secrets exercise

A majority of the participants felt their craftsperson team member was somewhat similar to them as compared to what they had expected.

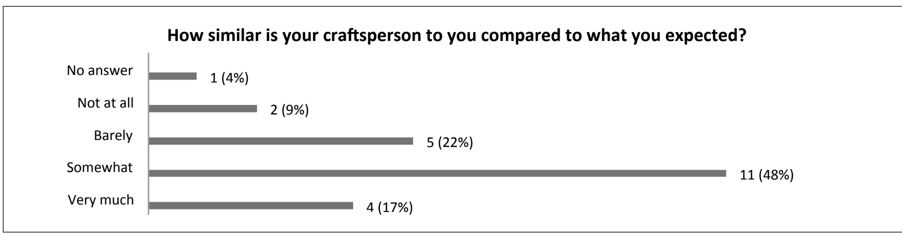

Figure 10.32: Findings from 23 respondents on how similar their craftsperson partner was to them as compared to what they had expected

Expert Presentations

A majority of participants found that the expert input sessions helped them a lot to expand their design concerns to the larger picture.

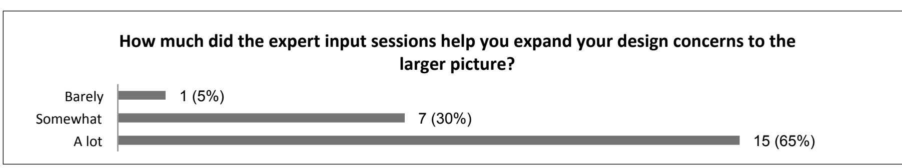

Figure 10.33: Findings from 23 respondents on the efficacy of expert input sessions

A majority of respondents cited design inputs as the additional input which could enhance the Rhizome Approach and workshop structure, with technical, sustainability and marketing factors following a close second. The factor rated No. 1 by a majority of participants we sustainability followed by design.

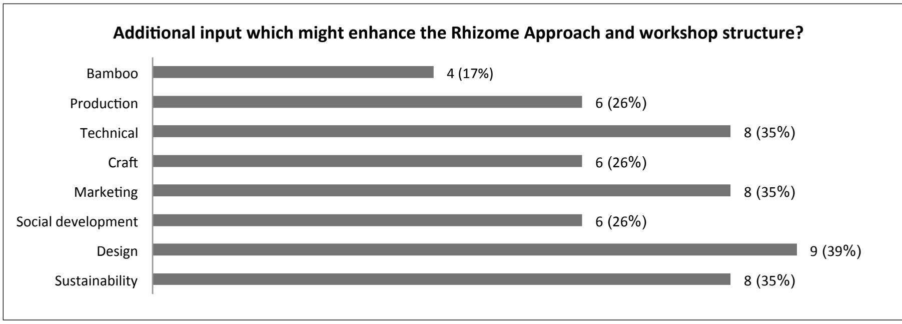

Figure 10.34: Findings from 23 respondents on additional inputs that might enhance the Rhizome Approach and workshop structure; participants could select more than one alternative.

A majority of the participants answered that the final product would have been very different or somewhat different without the collaborative process created by the different inputs.

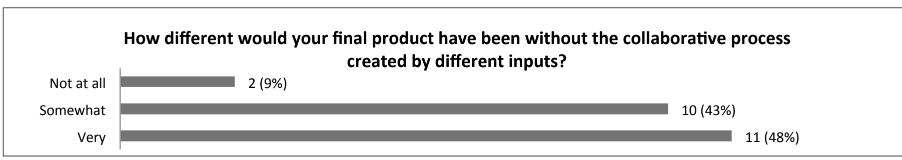

Figure 10.35: Findings from 23 respondents on how different their final product would have been without the collaborative process

STEP5

STEP6

10.7 MEASURING SUSTAINABILITY

Step 6 centers on increasing the designers' accountability towards the sustainability by quantifying the sustainability their designs have managed to achieve.

DESIGN

The quantification of sustainability is achieved through the evaluation of the designs against the Sustainability Checklist provided to the participants in Step 4. The designed product is evaluated against the checklist by the designer and two other evaluators. These three sets of data allow for investigator triangulation (Denzin, 1978) as a method of cross-validation of multiple-source data to identify regularities and discrepancies between the data sets. The result yields an indicative *sustainability quotient* of the product, which can be used as a reference for further development and also factored into the communication and marketing strategy.

The Sustainability Checklist was already shared with the designers in Step 4 (discussed in 10.5) to make them aware of the impact of design decisions on sustainability. The evaluation quantifies this impact, making the *sustainability quotient* of the product clearer. This quantification increases the designers' accountability to make changes and create iterations that make for a more sustainable final product.

Further information on the next iteration of the scoring method is discussed in Chapter 12, which also discusses how we adapted and developed the Sustainability Checklist for UNIDO.

ACTUALIZATION

The products produced by the innovation teams underwent three separate evaluations. The first was a self-evaluation by the designer; the second evaluation was by a community-development expert, and the third, by a design expert. The evaluation was interactive, so as to increase transparency, and also so the evaluators were able to share detailed feedback with the designers beyond the scoring. Each evaluator scored the product relative to the criteria outlined in each parameter. A score of 1 would indicate *low* or below average, 2 would indicate *medium* or average, and 3, *high* or demonstrably better. The final score per parameter was the triangulated mean of the three grades. This final score was reflected in the ecological, social, cultural and economic sustainability that the parameter impacts. The final scoring was communicated to the design participants.

FINDINGS

Self-evaluation

Twenty-one out of the 24 participants filled in the final questionnaire. Of these, about half of the participants felt that their design could have been very much improved after the self-evaluation process; the other half felt it could have been somewhat improved.

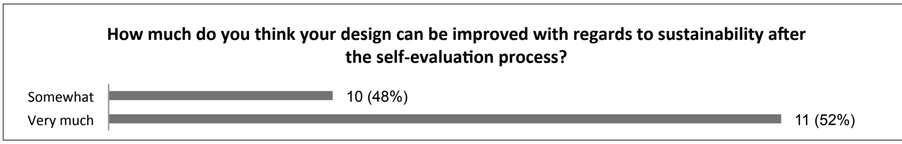

Figure 10.36: Findings from 21 respondents on whether they thought their design can be changed to better address sustainability following the self-evaluation process

A majority of participants answered that they found it somewhat difficult to evaluate themselves against the checklist.

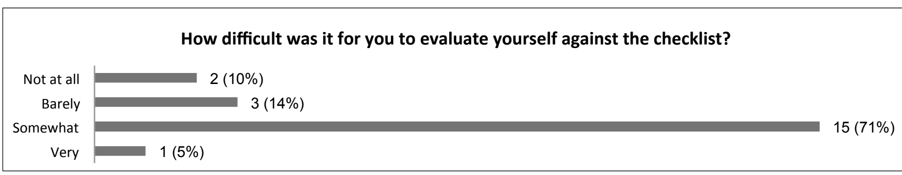

Figure 10.37: Findings from 21 respondents on how difficult it was to evaluate themselves against the Sustainability Checklist

External Evaluation

A majority of participants found the evaluation process with the two external evaluations very useful for them to rethink their design with regards to sustainability.

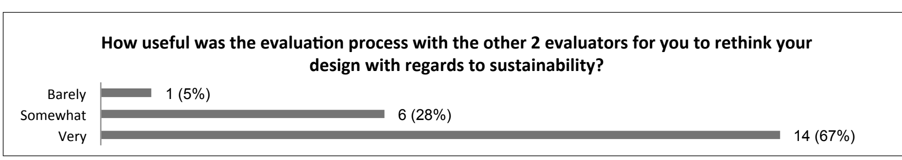

Figure 10.38: Findings from 21 respondents on the usefulness of evaluation process in rethinking design

A majority of participants ranked the inputs from the design expert as No. 1 towards making them consider changes in their product in order to make it more sustainable; this was followed by the self-evaluation, and the evaluation by the community expert.

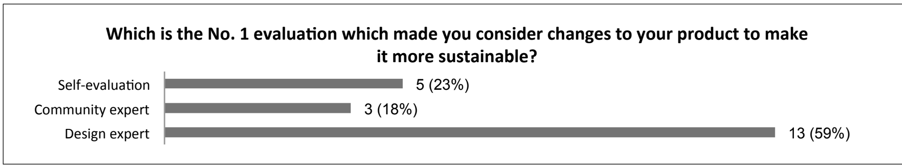

Figure 10.39: Findings from 21 respondents on the No. 1 evaluation which made them consider changes to their product to make it more sustainable

Evaluation Process

Of the participants who answered this question, the majority of participants felt the No. 1 way to make evaluation using the Sustainability Checklist easier, was to make it shorter. The second-most popular No.1 factor was that questions should be asked completely, e.g., "Is your product made from a single material?" instead of the single word, "mono-material". This was followed by the factors "clearer" and "making it digital."

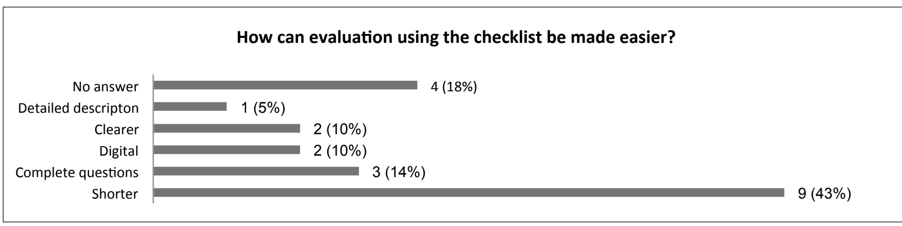

Figure 10.40: Findings from 21 respondents on how the evaluation using the checklist can be made easier

Use of the checklist in the future

A majority of participants said that they would use the checklist in the future to formulate their design briefs and also to evaluate their designs; some would use it just to formulate their design briefs.

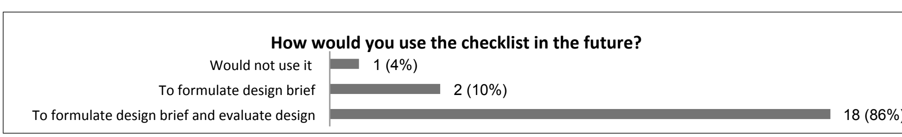

Figure 10.41: Findings from 21 respondents on how they would use the checklist in the future

STEP7

10.8 KEEP DESIGNERS IN THE LOOP UNTIL FINAL PRODUCT ACTUALIZATION

Step 7 centers on keeping designers in the loop until final product actualization, thereby retaining their responsibility towards making the end product sustainable. This is done by involving the designer in all the iterations of the design, from the prototype stage, right up to the final product actualization.

DESIGN

In the traditional pipeline design sequence, the production, costing and marketing revisions often happen between the time a product is realized and the time it is marketed. By this time, the product design function is essentially disbanded (White et al, 2008) and changes in the product are often made without the information or agreement of the innovator/innovation team. As a result, nobody has a bird's-eye view of the product and the cascading effect of the changes, including vis-à-vis sustainability. The workshop design therefore involved keeping the designers in the loop vis-à-vis tweaking and changes required as a result of the evaluation of Step 6—and as a result of the feedback from the experts across the production-to-consumption chain. The design team is kept in the loop along with the other design collaborators, until the final actualization of the product.

ACTUALIZATION

At the end of Step 6, each of the teams had designed and developed a working prototype which had been evaluated. Given the paucity of time, the development and refinement of these prototypes needed to be done after the workshop. Step 7 involved production and marketing experts examining the prototypes post-workshop, and suggesting changes to streamline production, and make the products more appealing and cost-effective. Additional changes post-workshop came from the designers themselves, as a result of the feedback they received during Step 6. Some of the changes required by the designers, production experts, and marketing experts meant radical restructuring of the product's form, construction and joinery. All these changes were examined collaboratively, and the relevant changes were incorporated in the product design, with the consent of, and in agreement with, the original design team. Thus, the design team was involved in the final product actualization even after the duration of the workshop.

FINDINGS

The process of making changes

None of the participants were ok with passing on the prototype to experts who would make changes to complete the prototype without informing them. A majority of participants wanted inputs from experts before deciding on the changes.

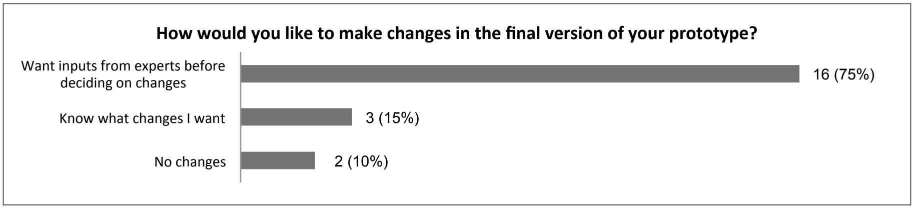

Figure 10.42: Findings from 21 respondents on whether they know what changes they want to make in their final version

10.8 ADDITIONAL FINDINGS

CROSS-CHECKING RELEVANCE OF THE BARRIERS WHICH UNDERPIN THE RHIZOME APPROACH

We validated the relevance of the barriers which underpin the Rhizome Approach through our baseline questionnaire. In this first questionnaire, the respondents were asked to circle the factors which hindered them from designing sustainably. In some cases, more than one question was posed to cover the subthemes each overall barrier encompassed. Figure 10.43 shows the barrier, the questions posed and the result. Figure 10.44 represents this graphically.

BARRIER	WHICH FACTORS HINDER YOU FROM DESIGNING SUSTAINABLY?	PARTICIPANTS WHO FELT THIS FACTOR IS A BARRIER
Lack of knowledge about sustainability	Q1 Lack of training/education in sustainable design	19
	Q2 Lack of access to information on sustainability statistics and data	17
	Q3 Lack of green material suppliers	13
Lack of a holistic overview of the production-to-consumption system	Q1 Lack of holistic overview of the production-to-consumption chain	10
Failure to include sustainability at a strategic level in the overall approach	Q1 Lack of interest in sustainability from the project team, e.g., prototypes, producers, etc.	12
	Q2 Sustainable design means more expensive products	13
Failure to include sustainability criteria in the design brief	Q1 Lack of including sustainability criteria alongside traditional criteria as a design parameter in the design brief	15
Lack of a collaborative design process	Q1 Lack of a collaborative design process	15
Lack of tools to measure holistic sustainability against indicators	Q1 Lack of tools to measure sustainability against indicators	14
Failure to keep the design team in the loop during product actualization	Q1 Lack of control over final product because of limited involvement in the actual product realization	11

Figure 10.43: Empirical validation of the barriers that underpin the Rhizome Approach

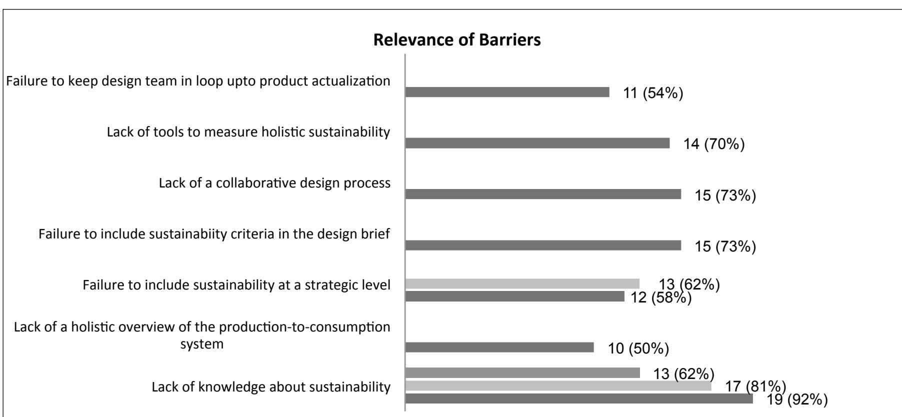

Figure 10.44: Findings from 21 respondents on validating the barriers that underpin the Rhizome Approach; respondents could select more than one option

MAPPING CHANGES IN CONCEPTS AND LEARNINGS FROM PRE-TO POST WORKSHOP

As discussed earlier, the workshop was monitored and documented, both in an audio-visual format and through text. Of the four questionnaires which were administered, the first served as a baseline of the participants' knowledge and understanding of concepts such as sustainability and craft. The last questionnaire repeated some of the key questions of the first questionnaire, to map the change in these concepts.

Change in knowledge about sustainability

Some of the participants were not familiar with sustainability-related concepts before the workshop. After the workshop all the participants were familiar with sustainability-related concepts. The number of participants who were somewhat familiar increased significantly. Interestingly, several of the participants who thought they were very familiar with sustainability-related concepts, answered that they were somewhat familiar, probably because the workshop exposed them to a lot of new concepts which helped them get a realistic picture of their knowledge level. Overall, all of these indicate that the workshop helped increase the familiarity with concepts relating to sustainability.

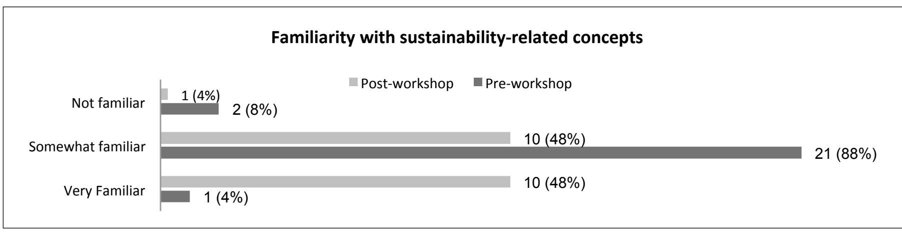

Figure 10.45: Findings from 24 respondents pre-workshop and 21 respondents post-workshop on familiarity with sustainability-related concepts

Change in knowledge about sustainable design

Only a few participants answered that they were very familiar with concepts relating to sustainable design before the workshop. Following the workshop, a majority of participants answered that they were very familiar with concepts relating to sustainable design. This indicates that the workshop helped increase the overall familiarity with concepts relating to sustainable design.

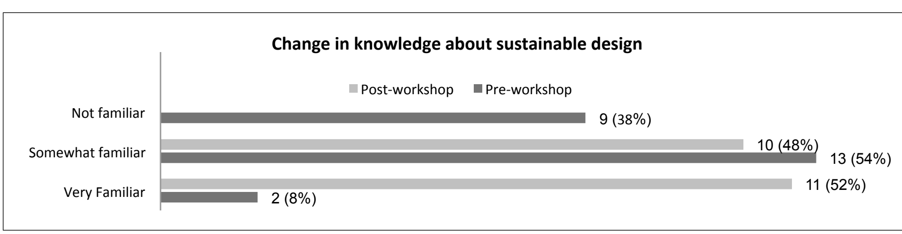

Figure 10.46: Findings from 24 respondents pre-workshop and 21 respondents post-workshop on change in their knowledge about sustainable design

Change in knowledge on sustainability models

Only 10 of 24 respondents were familiar with any sustainability model before the workshop and this model was Ecodesign. Following the workshop, the knowledge of models had expanded to include the Triple Bottom Line, Four Pillars Model, and Five Capitals Model.

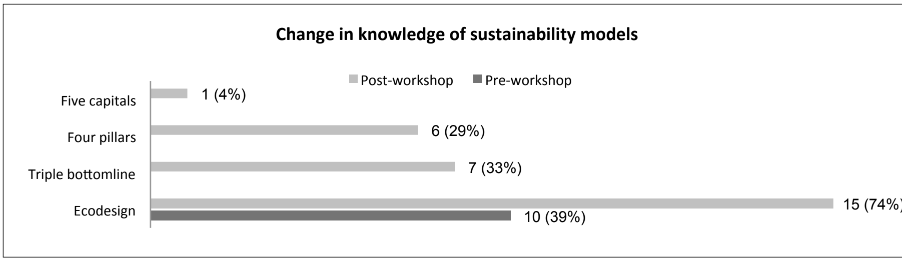

Figure 10.47: Findings from 24 respondents pre-workshop and 21 respondents post-workshop on change in their knowledge about sustainability models; respondents could select more than one alternative

Change in perception of aspects to be considered while designing sustainably

In the baseline questionnaire, the participants felt ecological, social, cultural, ethical and political aspects should be considered while designing sustainably. Following the workshop, the number of participants who felt these tenets should be considered, increased. Participants also felt that the ethical and political tenets which are not yet part of accepted sustainability models but have been discussed for quite some time now should be considered.

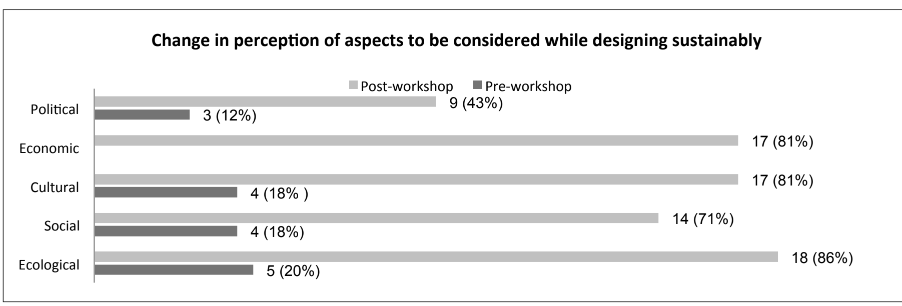

Figure 10.48: Findings from 26 respondents pre-workshop and 21 respondents post-workshop on change in their perception of aspects which need to be considered while designing sustainably before and after the workshop; respondents could select multiple alternatives.

10.9 SUMMARY AND CONCLUSIONS

This chapter presented the workshop design—the final output of the design-and-development phase of our research—to test whether the Rhizome Approach and its constituents helped designers to address sustainability in a more holistic manner through their designs. This was actualized through a workshop in India which explored the efficacy of each step and the framework as a whole.

While each of the mechanisms and steps overall received a positive response, the Sustainability Checklist received a high level of appreciation vis-à-vis its efficacy as both a brief and as an evaluation tool. A majority of participants also indicated they would use it in the future in their sustainable design practices. Also relevant were the numerous inputs from the participants on the factors which would make them more likely to use the checklist, which relates to Research Question 3. Apart from time and a better and clearer checklist itself, the participants cited pressure from clients, the government and peers—which relate to Research Question 3: What mechanisms would support and encourage the use and operationalization of any sustainability-design approach that might be developed in response to Research Question 2?

Based on this feedback, we decided to validate and refine the checklist in another setting, to serve as the basis to answer Research Question 3. The next chapter describes how we validated the findings from the workshop before developing the second iteration of the Sustainability Checklist (Chapter 12), and how it was used as an input in a branding and labeling scheme in Vietnam, towards the answer to Research Question 3.

11 TOWARDS A NEW THEORY: THE RHIZOME APPROACH

The previous chapter reported on a workshop conducted in India in 2010, whose findings indicated that the Rhizome Approach and its constituents, including the Rhizome Framework and Sustainability Checklist, were effective in helping the participating designers to address sustainability in a more holistic manner in the case of the bamboo craft of the Kotwalia community. Our next step was to validate these findings, and, if the process revealed scope for improvement, to create a final iteration of the existing design. In the case of quantitative research, validation is generally done by ascertaining external validity to check that the findings from this representative real-context test group are generalizable to the wider population (Emory & Cooper, 1991) across treatments, contexts and time (Cook & Campbell, 1979); and, in the case of qualitative research, by assessing transferability. Given the nature of our research, we proceeded to assess the transferability of our findings using the criteria developed by Lincoln and Guba (1985) to evaluate qualitative research; these criteria are analogous with the validity framework of quantitative research.

Design science research inherently does not aim to create cookie-cutter generalizable solutions. Instead, it aims to develop theoretical knowledge, whose value extends beyond the immediate real-context test group, in which the outputs were demonstrated and tested, to a larger research community (Gustavsen, 1993; Levin, 1993; McKay & Marshall, 2001; Susman & Evered, 1978) interested in the same problem class (Venable, 2009) (2.4). Our broad and diverse problem class (designers working with MSMEs in developing countries, working with renewable materials), the fact that every context is unique, and our intention that the Rhizome Approach is adapted to best suit each setting it is used in—these factors singly and collectively mean that our theoretical contributions cannot be grand narratives which provide turnkey solutions to the problem class (Drechsler, 2015). Therefore, we focused on assessing transferability to our problem class through two face-validity studies in settings different from our problem class.

1. VIETNAM: The first face-validity study was conducted by administering two questionnaires to a group of Vietnamese trainers with a background in sustainable product innovation in 2011. The intent was to check whether the overall response to the Rhizome Approach—and especially the positive response to the Sustainability Checklist and feedback on improving it—were similar in India and Vietnam. This phase and the findings from the questionnaire are discussed in 11.1.

2. WORLD: The second face-validity study was conducted by administering a questionnaire by e-mail to 15 designers located across Africa, Australia, Europe, Latin America, Turkey and Southeast Asia in 2016. The questionnaire explored whether the respondents felt there could be complementary, supplementary or alternative steps to the Rhizome Approach to make it more effective and to improve it in general. This phase and the findings thereon are discussed in 11.2.

In 11.3, we examine the quality of our research against Lincoln and Guba's (1985) criteria and offer a discussion on how our research addresses these criteria, with a view to substantiate the soundness of our research.

Finally, the summary and conclusions—especially vis-à-vis Research Question 2—are offered in 11.4.

11.1 TRANSFERABILITY: VIETNAM

The first phase to check the transferability of the findings from the workshop in India was conducted in Vietnam. The aim was to investigate whether the findings of the workshop in India were relevant in a proximally similar (Campbell, 1986) developing-country MSME setting, and with materials other than bamboo. Since several of the steps of the Rhizome Approach had been actualized in India in situ, through experiential learning and hands-on activity, it was not possible to validate them without replicating the entire Indian workshop in Vietnam. Even if we had followed the itinerary of the Indian workshop in Vietnam, it would have been impossible to recreate exactly the same settings. Moreover, doing so would have defeated our intention of cross-validation across a proximally similar (Campbell, 1986) context within the problem class. Therefore, we decided to check face validity—measure the robustness of the findings at face value—of the Rhizome Approach in general, and especially of the Sustainability Checklist, which had received positive feedback and interest in the workshop, with an expert group. We also aimed to verify whether the Indian designers' inputs on improving the checklist were in line with that of the Vietnamese respondents.

We administered two questionnaires (Annexures 9 and 10) to a group of 21 Vietnamese participants (Annexure 11) of the Sustainable Product Innovation (SPIN) project's Training of Trainers (ToT) Workshop 2 in Ho Chi Minh City, in May 2011. There were three main reasons to select the SPIN ToT group. The first was our academic and professional linkage with Delft University of Technology, through their SPIN project. The second was that SPIN's objective—to increase the competitiveness of MSMEs in Vietnam, Laos and Cambodia in the areas of food processing, textiles, footwear, handicrafts and furniture, by developing and producing more sustainable and innovation-centric products for domestic and European markets—resonated with the overall scope of our research. The third was that the

SPIN group consisted of experts who had already received inputs in the area of sustainable product innovation in the MSME context from the SPIN project; their potential expert inputs would strengthen the relevance of the face-validity results (Drost, 2011).

The first questionnaire was administered to set a baseline to map concept changes before and after the presentation. The second questionnaire was administered following a digital presentation on the Rhizome Framework and Rhizome Approach, including the Sustainability Checklist. With a view to increasing objectivity in the research, the presentation was made by Shauna Jin, a PhD researcher from Delft, who also administered the questionnaire. The difference in treatment (taking inputs before and after presentation by Shauna Jin rather than during an ongoing hands-on workshop co-facilitated by us), context (asking a group of Vietnamese trainers with expertise in sustainable-design innovation for MSMEs rather than Indian designers), and time (conducting a survey a year after the original results), strengthened our inquiry into transferability to a proximally similar setting within the problem class.

The key findings of this phase are shared below:

RELEVANCE OF THE BARRIERS WHICH UNDERPIN THE RHIZOME APPROACH

The relevance of the seven barriers which underpin the Rhizome Approach was ascertained by asking the participants whether these barriers hindered them from designing sustainably. In some cases, more than one question was posed to cover the sub-themes each barrier encompassed. This set of questions was identical to the ones posed in the workshop in India. Fig. 11.1 shows the barrier, the questions posed and the findings; Fig. 11.2 represents this graphically comparing the findings from India and Vietnam. The findings indicate that the barriers which underpin the Rhizome Approach are indeed relevant to the Vietnamese MSME context.

BARRIER	WHICH FACTORS HINDER YOU FROM DESIGNING SUSTAINABLY?	PARTICIPANTS WHO FEEL THIS FACTOR IS A BARRIER
Lack of knowledge about sustainability	Q1 Lack of training/education in sustainable design	17
	Q2 Lack of access to information on sustainability statistics and data	16
	Q3 Lack of green material suppliers	17
Lack of a holistic overview of the production-to-consumption system	Q1 Lack of holistic overview of the production-to-consumption chain	11
Failure to include sustainability at a strategic level in the overall approach	Q1 Lack of interest in sustainability from the project team, e.g., prototypes, producers, etc.	17
	Q2 Sustainable design means more expensive products	13
Failure to include sustainability criteria in the design brief	Q1 Lack of including sustainability criteria alongside traditional criteria as a design parameter in the design brief	13
Lack of a collaborative design process	Q1 Lack of collaborative design process	16
Lack of tools to measure holistic sustainability against indicators	Q1 Lack of tools to measure sustainability against indicators	14
Failure to keep the design team in the loop during product actualization	Q1 Lack of control over final product because on limited involvement in the actual product realization	15

Figure 11.1: Empirical validation of the barriers that underpin the Rhizome Approach with 21 Vietnamese participants

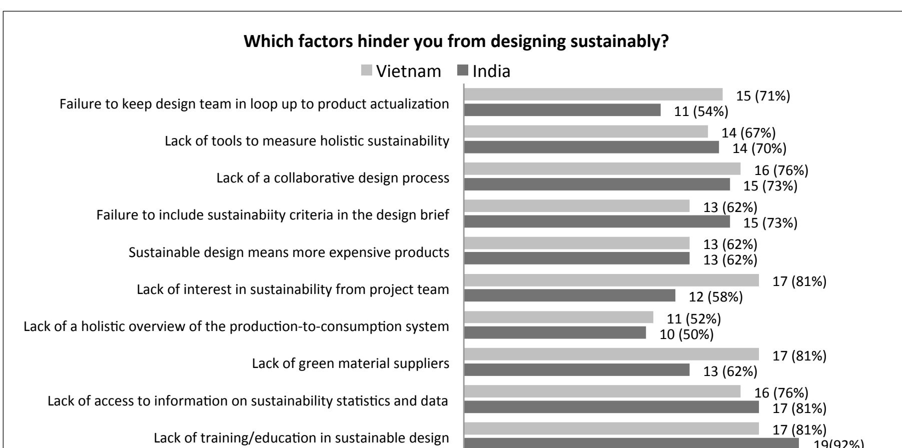

Figure 11.2: Comparison between findings from 21 Vietnamese and 21 Indian respondents on the relevance of the barriers that underpin the Rhizome Approach; respondents could choose more than one alternative.

Relevance of Rhizome Framework (Fig. 11.3)

As many as 17 out 21 Vietnamese respondents found the directions outlined by the Rhizome Framework relevant to their context, which indicates that the framework is potentially applicable to craft scenarios in developing countries such as India and Vietnam.

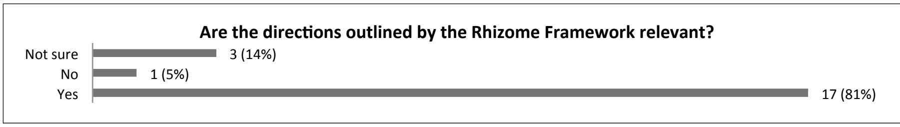

Figure 11.3: Findings from 21 Vietnamese sustainable-innovation trainers on the relevance of the Rhizome Framework

COMPARISON OF FINDINGS ON SUSTAINABILITY CHECKLIST BETWEEN INDIA AND VIETNAM

Usefulness of Sustainability Checklist in understanding sustainability concerns (Fig. 11.4)

The findings from India and Vietnam on the usefulness of the Sustainability Checklist in understanding sustainability concerns were very similar. A majority of the respondents in both countries found it very useful.

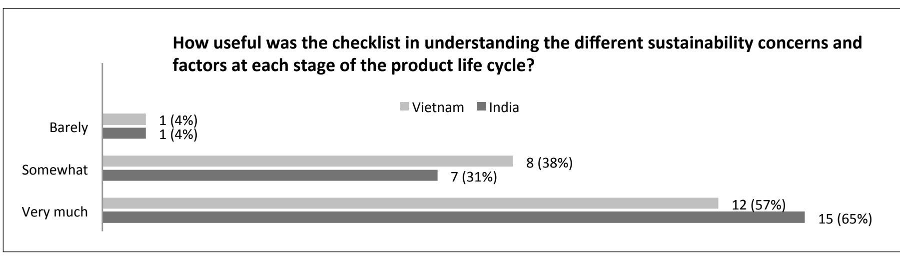

Figure 11.4: Comparison between findings of 21 Vietnamese and 23 Indian respondents on usefulness of the Sustainability Checklist in understanding sustainability concerns

New sustainability-related factors learned through Sustainability Checklist (Fig. 11.5)

More Indian respondents than Vietnamese ones seem to have learned new sustainability-related factors through the Sustainability Checklist. This may be because the Indian respondents were design students who had little exposure to sustainability, while the Vietnamese respondents had received several inputs in sustainability already.

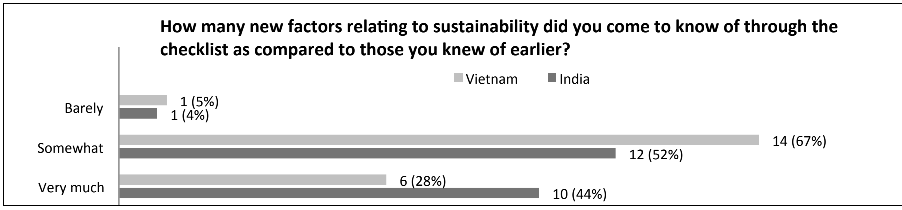

Figure 11.5: Comparison between findings of 21 Vietnamese and 23 Indian respondents on the usefulness of the Sustainability Checklist in creating awareness on different sustainability factors

Understandability of the Sustainability Checklist (Fig. 11.6)

Compared to their Indian counterparts, more Vietnamese respondents understood the Sustainability Checklist just by reading it. This may be because the Indian respondents were design students who had little exposure to sustainability, while the Vietnamese respondents had received several inputs in sustainability already. This possibility is bolstered by the fact that more Indian respondents than Vietnamese respondents could understand the checklist after each factor was explained.

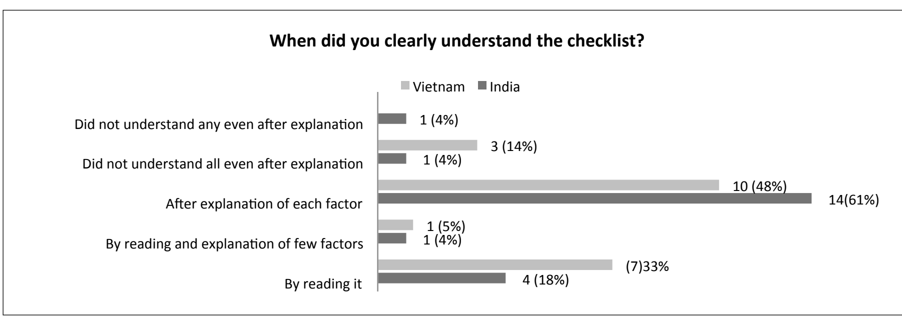

Figure 11.6: Comparison between findings of 21 Vietnamese and 23 Indian respondents on the understandability of the Sustainability Checklist

Booklet to explain factors of the Sustainability Checklist (Fig. 11.7)

The findings on the usefulness of a booklet to explain the Sustainability Checklist's factors were very similar and positive in both sets of respondents.

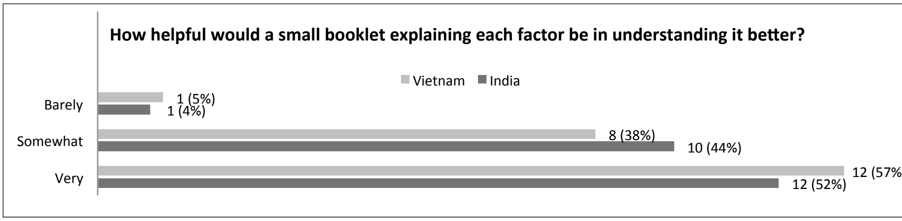

Figure 11.7: Comparison between findings of 21 Vietnamese and 23 Indian respondents on the usefulness of a booklet to understand the factors of the Sustainability Checklist

Use of Sustainability Checklist in future practice (Fig. 11.8)

About half of the respondents said they would use the checklist a lot while only a few said they would not.

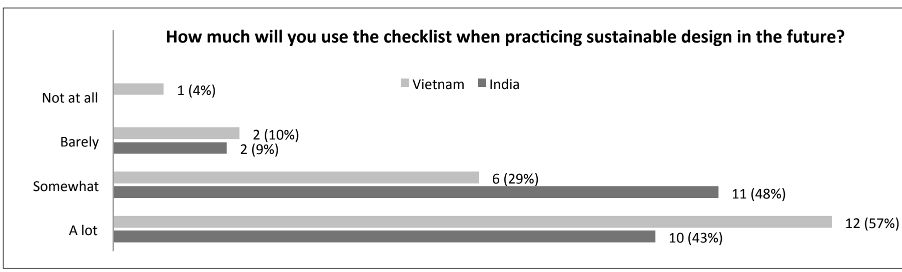

Figure 11.8: Comparison between findings of 21 Vietnamese and 23 Indian respondents on the use of the Sustainability Checklist in future practice

Factors which can increase the use of the Sustainability Checklist (Fig. 11.9)

The findings were similar in both India and Vietnam with regards to factors which would increase the use of the Sustainability Checklist. The second-most popular factor in India—better explained with a booklet— was the most popular factor in Vietnam.

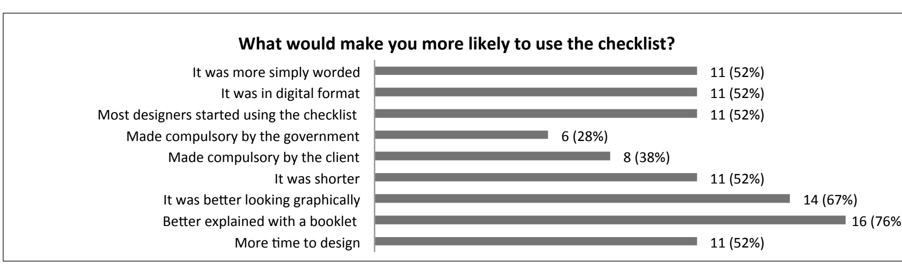

Figure 11.9: Findings from 21 Vietnamese respondents on factors that would make them more likely to use the Sustainability Checklist

MAPPING CHANGES IN CONCEPTS AND LEARNINGS FROM PRE- TO POST-PRESENTATION

One of the aims of administering two questionnaires was to check whether the inputs on the Rhizome Approach shared through a concise presentation—especially when compared to the workshop whose duration was 15 days, and included experiential and hands-on modules—impacted knowledge and concept changes. In order to do this, two questionnaires were administered. The first established a baseline of the participants' knowledge and understanding of sustainability-related concepts before the presentation and exposure to the Rhizome Approach, and the second repeated some of the key questions to map the change in these concepts.

Change in knowledge about sustainability (Fig. 11.10)

The findings indicated that the number of respondents who were very familiar with concepts relating to sustainability increased by 10% following the presentation. This indicates that the presentation's inputs helped increase the overall familiarity with concepts relating to sustainability.

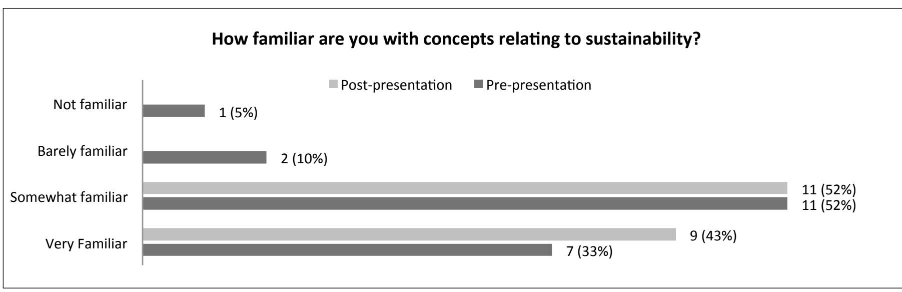

Figure 11.10: Change in knowledge about sustainability among 21 Vietnamese sustainable-innovation trainers pre- and post-presentation

Change in knowledge about sustainable design (Fig. 11.11)

There was a 13% drop in the participants who felt they were very familiar with concepts relating to sustainable design following the presentation. This corresponded with a 19% increase in participants who felt they were barely familiar with concepts relating to sustainable design following the presentation. These findings are surprising and, on the face of it, seem to indicate a knowledge loss following the presentation. One possible explanation is that the inputs from the presentation helped participants evaluate the extent of their knowledge gap with regards to concepts relating to sustainable design. We feel this merits further investigation, including by replicating this exercise with a larger number of respondents. This is because our small number of respondents restricts us from going beyond merely reflecting a qualitative tendency.

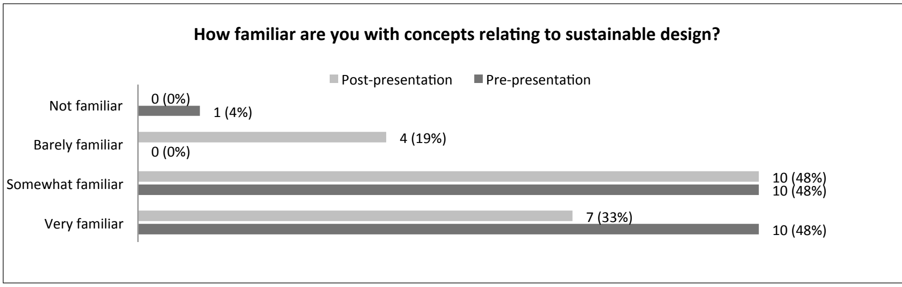

Figure 11.11: Change in knowledge about sustainable design among 21 Vietnamese sustainable-innovation trainers pre- and post-presentation

Change in knowledge on sustainability models (Fig. 11.12)

Following the presentation, the knowledge of models had expanded: 9% more respondents knew about Ecodesign and 5% knew more about the Triple Bottom Line than before the presentation. The percentage of respondents who knew about the Four Pillars and Five Capitals models remained constant.

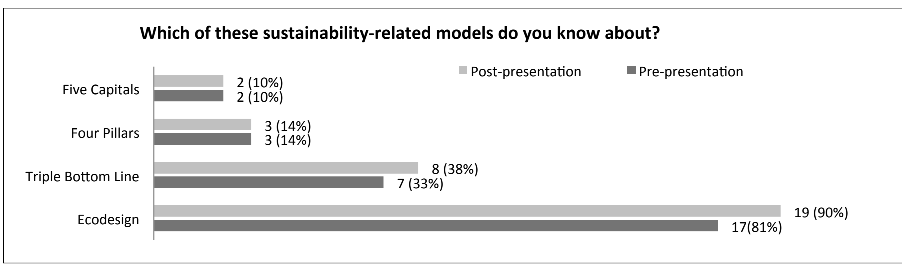

Figure 11.12: Change in knowledge about sustainability models among 21 Vietnamese sustainable-innovation trainers pre- and post-presentation; respondents could choose multiple options.

Change in perception of aspects to be considered while designing sustainably (Fig. 11.13)

Following the presentation, the percentage of participants who felt ecological, cultural, economic and political aspects should be considered while designing sustainably, increased. The perception on the social factors remained constant, whereas the perception that ethical and economic factors are important to sustainable design, decreased. This seems to indicate the respondents' acceptance of the Four Pillars model.

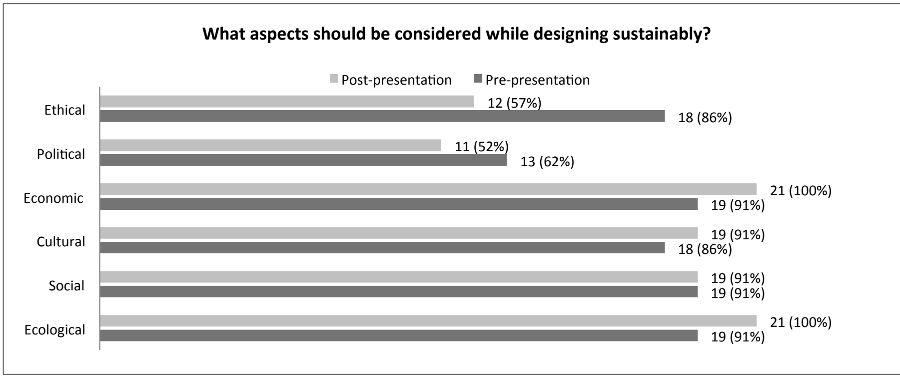

Figure 11.13: Change in perception of aspects to be considered while designing for sustainability among 21 Vietnamese sustainable-innovation trainers pre- and post-presentation

Change in perception of the aim of sustainable design (Fig. 11.14)

Before the presentation, most of the participants cited environment factors—preservation, pollution reduction, and global warming—as aims of sustainable design. The economic factor or increasing business and sales was the factor that was cited by the second largest majority. Social factors were cited above cultural factors. Following the presentation, the percentage of respondents who cited each factor dropped, except in the case of reducing pollution which remained constant. These findings are contradictory to what was expected, and merit future research. As cited earlier, the small number of our respondents limits us from going beyond merely reflecting a qualitative tendency.

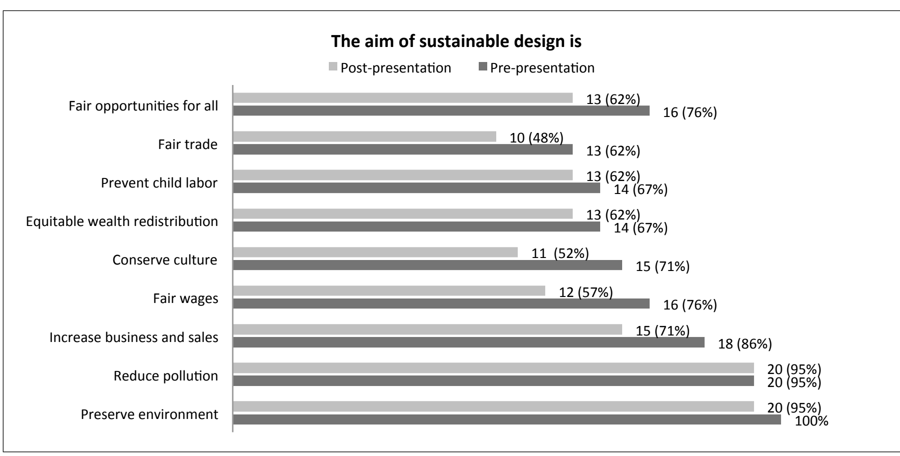

Figure 11.14: Change in perception of the aim of sustainable design among 21 Vietnamese sustainable-innovation trainers pre- and post-presentation

11.2 TRANSFERABILITY: GLOBAL

The second face-validity exercise to check the transferability of the findings from the workshop in India was conducted by administering a questionnaire to a cross section of 15 designers located in different regions around the world—four from Southeast Asia, four from Africa, one from Turkey, one from Australia, three from Europe, and two from Latin America (Annexure 12). In order to provide the respondents with the same background information on the Rhizome Approach, we created a 10-minute YouTube video (Reubens, 2016) explaining the approach. Each of the respondents was sent a link to this video along with the questionnaire (Annexure 13), which explored what the respondents thought about the steps of the approach, and whether they felt there could be complementary, supplementary or alternative steps to the Rhizome Approach to make it more effective. The questionnaire was administered in 2016 to check the transferability of the Rhizome Approach. The difference in treatment (taking inputs without a workshop, or a presentation, but after a YouTube video), and context (asking a group of designers located around the world rather than Indian or Vietnamese designers) strengthened our inquiry into transferability to a proximally similar setting within the problem class. The findings of this phase are shared below:

Potential of Rhizome Approach vis-à-vis Problem Context (Fig. 11.15)

Four-fifths of the respondents felt that following the seven steps of the Rhizome Approach would help designers to address sustainability in a holistic manner while working with craft-based MSMEs in the developing world.

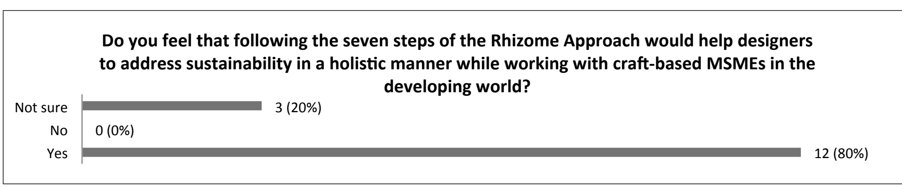

Figure 11.15: Findings on the potential of the Rhizome Approach from 15 designers across the world

Grading of Importance of Steps of Rhizome Approach (Fig. 11.16)

We asked the designers to rate the importance of the steps of the Rhizome Approach vis-à-vis their potential to help designers to address sustainability in a holistic manner, while working with craft-based MSMEs in the developing world. As can be read from Figure 11.16, Step 4 got the highest rank (7 designers), followed by step 3 (4 designers). Steps 2, 4, 5 and 7 were rated as the most important step by one designer each.

RATED	STEP 1	STEP 2	STEP 2	STEP 4	STEP 5	STEP 6	STEP 7
#1	7	1	1	5		1	1
#2	1	2	3	3	2	4	1
#3	4	1	6	2	1	2	1
#4	1	1	2	2	3	2	2
#5	1	5	1	2	3	1	
#6	0	3	1		5	3	3
#7	1	2	1	1	1	2	7

Figure 11.16: Hierarchical ranking of the steps of the Rhizome Approach by 15 designers located across the world

Additional Steps that can make the Rhizome Approach More Effective (Fig. 11.17)

The majority of respondents were not sure whether there could be additional steps which could make the Rhizome Approach more effective.

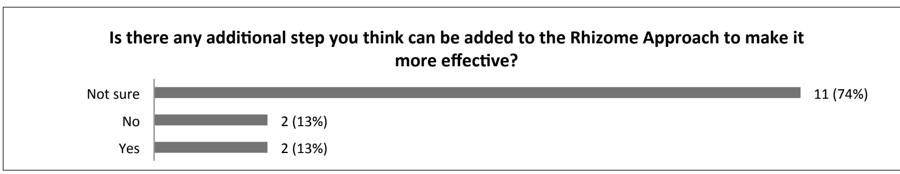

Figure 11.17: Findings on whether additional steps can increase Rhizome Approach's efficacy from 15 designers located across the world

The respondents had the following comments with regards to this question:

Build upon existing indigenous knowledge

"It seems what you are proposing is not building on the indigenous knowledge people have. That should be the starting point to find out about the indigenous knowledge systems craftspeople have and then build the seven steps onto their IKS [Indigenous knowledge systems]. This will make the craft people accept your proposal because it will be an extension of what they already know."

Outline involvement of each member of design team and discursive steps

"I think the additional step would be to identify the involvement of each member of the design team throughout the process especially in on their roles in regards of sustainability. Also maybe to view the steps in the discursive nature (can be conducted independently)."

STEP1

DIDACTIC KNOWLEDGE THROUGH KNOWLEDGE KIT TO PROVIDE INFORMATION AND KNOWLEDGE ON THE CORE CONCEPTS OF SUSTAINABILITY

SHOULD STEP 1 BE PART OF THE RHIZOME APPROACH?

When asked, “Do you feel that Step 1 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” all of the 15 respondents answered yes. Specific comments were as under:

• “It should also be addressed to non-designers. Sustainability and the education around it should be easily accessible to not just one group of creative practitioners.”
• “Yes, start at the source!”
• “Yes, but not the first step. Knowledge is something that people will gather once they are triggered.”

Is didactic learning through digital presentations and background reading material about sustainability a good way to implement Step 1?

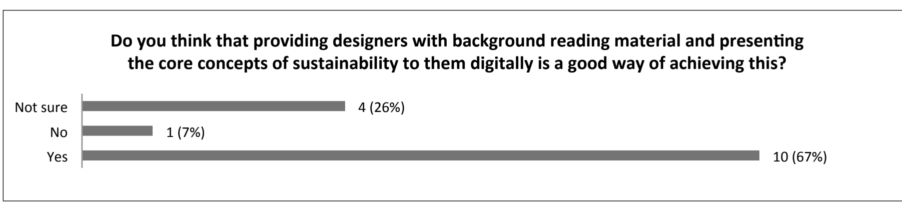

Figure 11.18: Findings on the implementation of Step 1 from 15 designers located across the world

Most of the respondents felt providing designers answered that didactic learning digitally and through background reading material about sustainability was a good way to implement Step 1 (Fig. 11.18). Additional points that emerged from the comments included:

Adaptability:
“It depends on localities in regard to reading cultures and effective usage of the program.”

Easy-to-use, engaging format:
"Most designers are visual learners (my assumption), and they might feel less motivated to read text-heavy information."

"I would recommend online courses/e-learning or videos."

"PPT (digital presentations using Microsoft PowerPoint) is ok, but human contact and interaction will always trigger people a lot more. A PPT is more for background research. Also, a website where these things are easily findable, locatable is a lot easier. Also, because then it is readily available and a search function easily applied."

Add-on knowledge:
"Yes, as an introductory phase, but they also need to expand this knowledge along the way (need support in this expansion)."

BETTER WAYS TO ACTUALIZE STEP 1

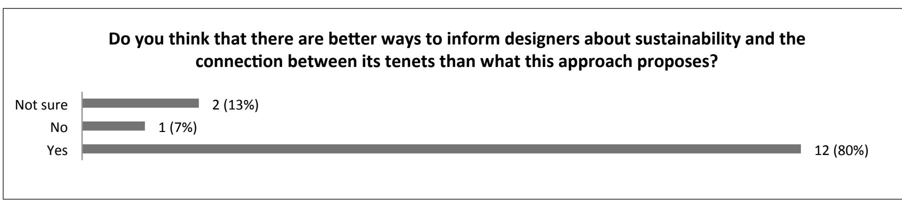

Figure 11.19: Findings on better ways to actualize Step 1 from 15 designers located in different parts of the world

Four-fifths of the respondents felt there were better ways to realize Step 1 than what the Rhizome Approach proposed (Figure 11.19). Points that emerged from their comments are:

Nonacademic, visual-rich format
"Designers can connect and communicate ideas, philosophies and concepts to a large group of industry practitioners. They speak the language of engineers, marketers, manufacturers, etc. If the information they receive is very academic, then they will lack the ability to easily digest information specifically developed for the design language."

"Visuals are key."

"I think a PPT is important, but designers are usually not always very intellectual, they are more practical and like to interact in other ways. So there could be more of a design-thinking approach where you use scenarios and make them learn through those scenarios with design thinking principles. Also other great forms of exploring sustainability is through videos, documentaries, animations, and infographics."

Digital tools
“Website/web platform, etc.; sustainability tool kit on CD/DVD ”

“Providing online tools where you can find the methodology and how to apply it. It could be similar to Invision, but for sustainable design.”

“Provide tools to introduce different aspects of sustainability for designers to adapt in their project. For example, one project might focus on sustainable material and the other on energy efficiency. Thus the idea and practice of sustainability can be adopted as part of their working culture slowly over time.’

Hands-on learning
“Approach this through the concept of learning-by-doing. Craft people (sic) are hands-on people and demonstrations using live projects would be more beneficial to them.”

“Learning by doing training”

“In my experience, designers are more ‘actors’ than ‘readers/listeners.’ Sustainability should be a mandatory course and design students have to really experience what sustainable design means, what the benefits are, etc. I would not only inform them about what sustainability is, but also let them execute a design project and compare the outcomes per team to indicate differences and why they emerge.”

Collaborative learning
“Seminars, collaborative meetings with other companies, role-model companies or designers/employees. They can inspire others.”

Case studies
“Showing videos; demonstrating real-life cases with scenarios”

“Show them the concrete outcome of some case studies to inform them how others have contributed to sustainability through design and succeeded. It would be the motivation and inspire designers somehow. (Maybe you already include this in the PPT presentations by experts; I just emphasize it because I think this is important).”

STEP2

EXPERIENTIAL LEARNING THROUGH EXPOSURE VISITS TO DIFFERENT NODES OF THE PRODUCTION-TO-CONSUMPTION SYSTEM

SHOULD STEP 2 BE PART OF THE RHIZOME APPROACH?

When asked, “Do you feel that Step 2 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” all 15 of the respondents answered yes.

Are exposure visits to different nodes of the production-to-consumption system and value chain a good way to implement Step 2?

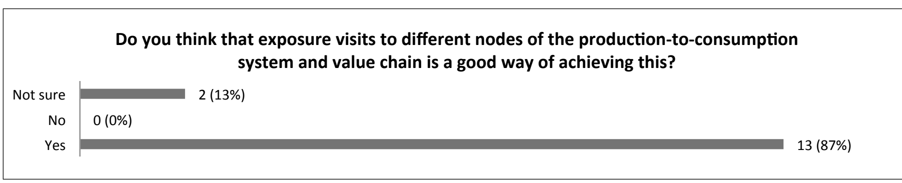

Figure 11.20: Findings on the implementation of Step 2 from 15 designers located in different parts of the world

Most of the respondents felt exposure visits were a good way to realize Step 2 (Fig. 11.20). One additional comment was:

> “Exposure visits are important but there should be more things to achieve this step.”

BETTER WAYS TO ACTUALIZE STEP 2

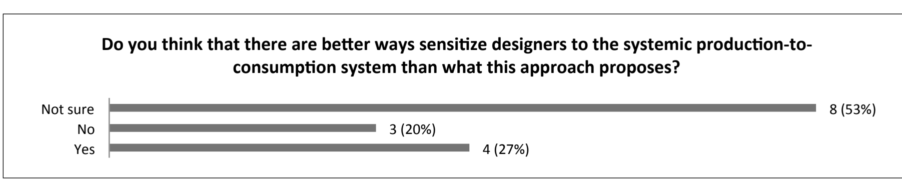

Figure 11.21: Findings on better ways to actualize Step 2 from 15 designers located in different parts of the world

Four of the 15 respondents felt there were better ways to realize Step 2 than what the Approach proposed (Fig. 11.21). Their comments included:

Seminars/workshops/design clinics
"Adopting the design clinic scheme/approach. Seminars/workshops, needs assistants, surveys will help a lot."

"Case studies of past experiences; practical workshops"

Background information
"In my experience, designers often lack time to do everything they want to. I am not sure if they will make time to visit producers. So, I would provide information about producers as well and advise experiential learning, as I do think that is a better way to learn."

"But I think a lot of the lack of knowledge and holistic view is due to design education. So there could a lot be done in education"

"To be exposed to value chains from other sectors, especially those who already adopt some sustainability practices within their industry, e.g., the food sector."

STEP3

INTERNALIZATION OF SUSTAINABLITY AT A STRATEGIC LEVEL THROUGH DISCUSSSIONS AND EXPERIENTIAL LEARNING

SHOULD STEP 3 BE PART OF THE RHIZOME APPROACH?

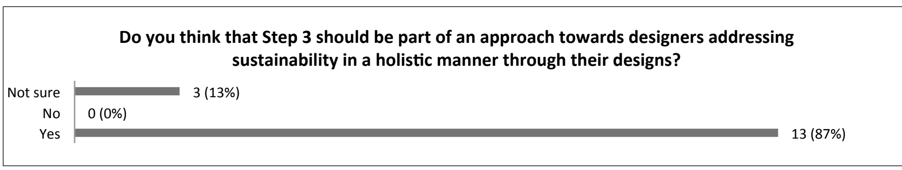

Figure 11.22: Findings on whether Step 3 should be part of the Rhizome Approach from 15 designers located in different parts of the world

When asked, “Do you feel that Step 3 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” most of the respondents answered yes.

Is internalization through sharing a common framework and concept mapping to understand its relevance a good way to implement Step 3?

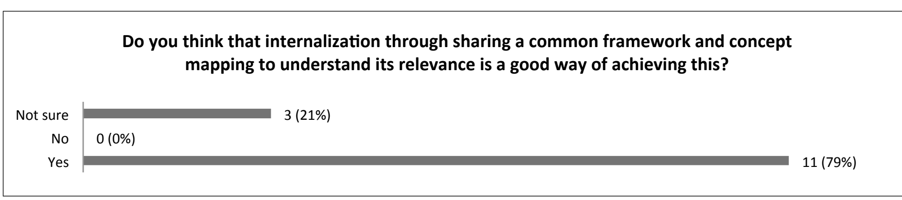

Figure 11.23: Findings on the implementation of Step 3 from 15 designers located in different parts of the world

Figure 11.23 presents the findings on whether the 15 respondents found the means we applied to implement Step 3 of the Rhizome Approach competent. One comment was:

> “I think it is very relevant to have everyone on the same page and work together towards a shared goal.”

BETTER WAYS TO ACTUALIZE STEP 3

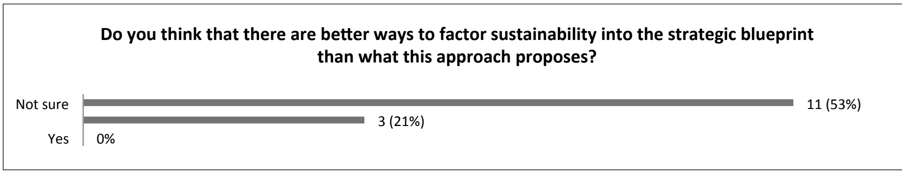

Figure 11.24: Findings on better ways to actualize Step 3 from 15 designers located in different parts of the world

Around half the respondents were not sure whether there were better ways to realize Step 3 than what the Rhizome Approach proposed (Fig. 11.24). Their comments included:

Ownership
"Maybe again add creative techniques. In that way, people feel more ownership of the goal they together created. If it is forced upon you, you are less likely to accept it."

Adaptable and still measureable framework
"I definitely agree that there should be a common framework, I did an LCA diploma and we use to talk about how could we be able (sic) to measure and compare one product with the other in terms of sustainable impact if you have evaluated them in different ways? Following the same methodology/framework would really help, but it has to be a methodology that can be tropicalized to the area where it is going to be used; i.e., the economical state of Mexico is not the same to the one of Tanzania, so how do you measure value and price, and how do you measure then what fair trade is?"

Enterprise preparedness
"I think it is important for companies to be prepared internally, before adopting sustainability practices at a strategic level. Often sustainability will be sacrificed against economic gain (sic) therefore adaptation needs to take this reality into account."

STEP4

CLEAR BRIEF SUPPLEMENTED BY THE SUSTAINABILITY CHECKLIST TO CLARIFY DESIRED DESIGN DIRECTIONS AND THEIR IMPACT ON EACH TENET OF SUSTAINABILITY

SHOULD STEP 4 BE PART OF THE RHIZOME APPROACH?

When asked, “Do you feel that Step 4 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” all of the 15 respondents answered yes.

Is a clear brief supplemented by the Sustainability Checklist to clarify design directions and their impact on each tenet of sustainability a good way to actualize Step 4?

When asked, “Do you think that a clear brief supplemented by the Sustainability Checklist to clarify desired design directions and their impact on each tenet of sustainability is a good way of achieving this?” all of the 15 respondents answered yes.

BETTER WAYS TO ACTUALIZE STEP 4

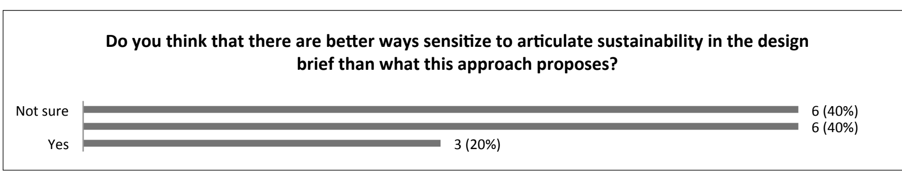

Figure 11.25: Findings on better ways to actualize Step 4 from 15 designers located in different parts of the world

A few of the respondents felt there were better ways to realize Step 4 than what our approach proposed (Fig. 11.25). A comment was:

“This is a very practical tool which is needed with all the fuzzy other steps.”

Points emerging from their other comments were:

Dovetail the checklist with other tools

“Visit the Life’s Principle checklist found in Biomimcry. The checklist can assist the development of the brief in order to ensure a more sustainable outcome.”

Ensure that the checklist does not mean complacency

"The checklist should not become *just a checklist* which designers use to demonstrate they did the best they could. They should really strive to be *better than the checklist*, be creative in their solutions and therefore also in their requirements. So, maybe attach an exercise to the checklist which makes designers think further, specifically for their project."

"Our vision is limited sometimes and somehow. So the design brief that we define at the beginning is not always clear and in the right direction. We need to think about how to put all forces of different nodes of the production-to-consumption system and synthesis them in the design. We have to identify the right questions to find out the problem that we have then we attempt to rephrase the problem to find out the new point of view to solve the problem."

STEP5

CONSTANT LINKAGE AND INTERACTION WITH STAKEHOLDERS OF THE PRODUCTION-TO-CONSUMPTION SYSTEM TO FACILITATE COLLABORATIVE DESIGN

SHOULD STEP 5 BE PART OF THE RHIZOME APPROACH?

When asked, “Do you feel that Step 5 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” all of the 15 respondents answered yes.

Are icebreaking and team-building exercises a good way to implement Step 5?

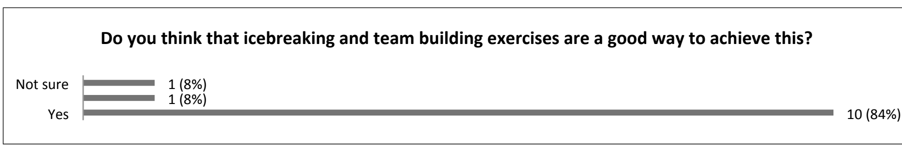

Figure 11.26: Findings on the implementation of Step 5 from 15 designers located in different parts of the world

Fig. 11.26 presents the findings on whether the 15 respondents found the means we applied to implement Step 5 of the Rhizome Approach competent. In addition, their comments reinforced collaborative innovation and were as under:

“Yes, I do believe building shared experiences would enhance the collaboration process in design.”

“I think it might be good to meet everyone so it is easier to approach everyone, and keep everyone in the loop, but the exercises must not consume too much time.”

“I think the collaborative-design approach needs to also take into account project objectives and the method that facilitated the process of working together.”

Are constant inputs from value-chain experts and stakeholders a good way to implement Step 5?

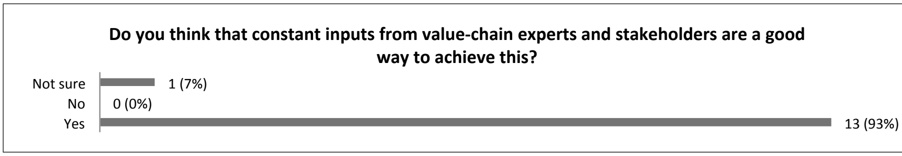

Figure 11.27: Findings on the implementation of Step 5 from 15 designers located in different parts of the world

Fig. 11.27 reflects the findings from 15 respondents. In addition, one comment was:

"Working across domains is difficult and inputs from one domain might be perceived differently by the others. Therefore, constant inputs without clear objectives might create confusion and stress across stakeholders involved."

BETTER WAYS TO ACTUALIZE STEP 5

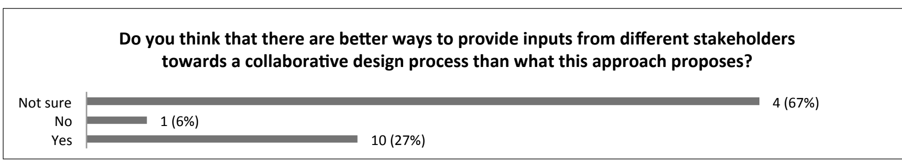

Figure 11.28: Findings on better ways to implement Step 5 from 15 designers located across the world

Some of respondents felt there were better ways to realize Step 5 than what the Rhizome Approach proposed (Fig. 11.28). Their comments included:

Collaborations to empower craftspeople
"Clustering craftspeople who are making similar objects."

Experiential learning
"By learning from them, by letting them show you what they do and why they do it. Or even do it yourself to experience how it is."

Including market feedback
"Such as including front-runner customers. Highly demanding customers, they can boost a company/product to a next level."

Focused inputs
"Facilitates the process by having clear objectives why the inputs are required at a certain stage of design process."

Look at existing frameworks and mechanisms
“Creating theory of change documents, value-chain track and other tools that add to the team building and ice breaking. Use similar approaches to the tool kit of Human Centered Design.”

“Design thinking principles, and the 7 Hats principles are also great strategies that can be used together with the icebreaking and team-building (exercises). I think brainstorming together at the beginning of a project and then feedbacking each other throughout the process is very crucial.”

STEP6

EVALUATION OF DESIGN AGAINST THE SUSTAINABILITY CHECKLIST BY THREE EVALUATORS

SHOULD STEP 6 BE PART OF THE RHIZOME APPROACH?

When asked, “Do you feel that Step 6 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” 100% of the respondents answered yes.

Is evaluation of the design against the checklist by three evaluators a good way to implement Step 6?

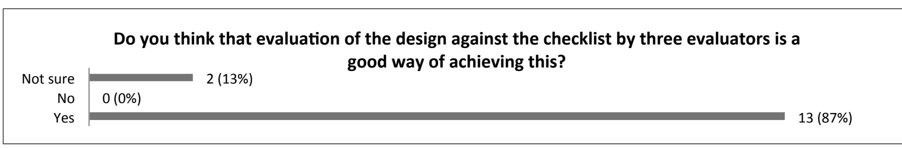

Figure 11.29: Findings on the implementation of Step 6 from 15 designers located across the world

Figure 11.29 presents the findings on whether the 15 respondents found the means we applied to implement Step 6 of the Rhizome Approach competent. Their comments are as below:

“Yes, for being able to compare projects with each other it is good to have a common measurement standard. However, I think this checklist should be continuously updated and improved upon, based on new insights and I think that designers should be able to add to it.”

“Yes, especially when external experts evaluate too.”

BETTER WAYS TO ACTUALIZE STEP 6

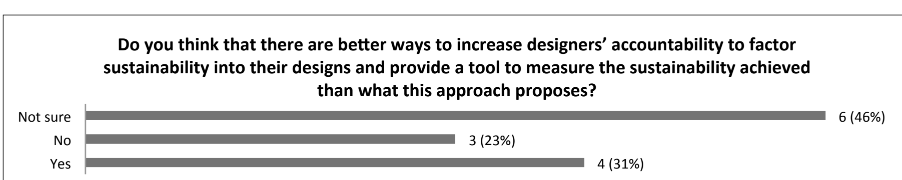

Figure 11.30: Findings on better ways to implement Step 6 from 15 designers located across the world

Almost half of the respondents felt there were better ways to realize Step 6 than what the Rhizome Approach proposed (Fig. 11.30). Their comments included:

Output but also outcome
"Maybe the measurement should also be done a year after implementation to check if the design has the expected outcome or not."

Look at other frameworks
"Follow up on the LeNSes program that runs through the Politecnic di Milano. It has a developed set of tools and models to assist designers to measure the level of sustainability that they wish to achieve."

"Also look at other frameworks."

Carrot instead of stick
"Incentives from managers, not necessarily monetary but in the form of other appraisals could also work."

Link this to Step 1
"Maybe this step can be used to support Step 1 (as part of the introductory kit); thus the information and content can be understood and adopted at the earliest stage."

STEP 7

INVOLVING DESIGN TEAM IN ALL ITERATIONS OF THE DESIGN UP TO FINAL PRODUCT ACTUALIZATION

SHOULD STEP 7 BE PART OF THE RHIZOME APPROACH?

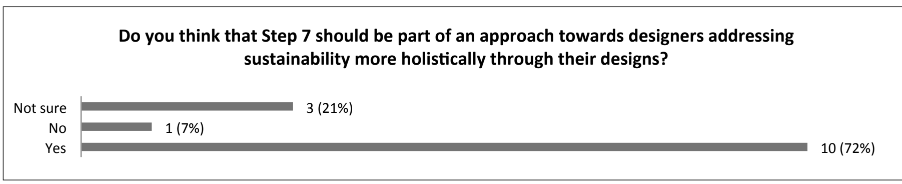

Figure 11.31: Findings on whether Step 7 should be part of the Rhizome Approach from 15 designers located across the world

When asked, “Do you feel that Step 7 should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?” a majority answered yes (Fig. 11.31). This was the only step which the participants did not unanimously agree on being part of the Rhizome Approach. Additional comments included:

“I see the relevance by your example of the glue. Otherwise I would have doubted its relevance, as in my experience designers are always involved until the end.” (The glue referred to here is a practical example cited in the YouTube video to better explain this step.)

Is involving the design team in all iterations of the design up to the final product actualization a good way to implement Step 7?

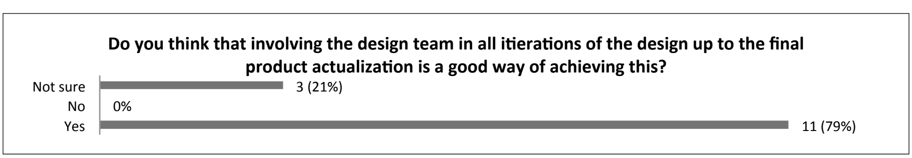

Figure 11.32: Findings on the implementation of Step 7 from 15 designers located across the world

Figure 11.32 presents the findings on whether the 15 respondents found the means we applied to implement Step 7 of the Rhizome Approach competent. A single comment is as below:

"At least one designer, yes."

BETTER WAYS TO ACTUALIZE STEP 7

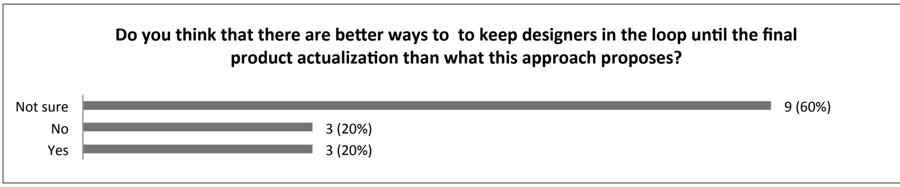

Figure 11.33: Findings on better ways to implement Step 7 from 15 designers located across the world

Three respondents felt there were better ways to realize Step 7 than what our approach proposed (Fig. 11.33). Points emerging from the comments included:

On how to keep the design team in the loop
"Incentives go a long way in motivating team members"

"E-mails might be missed, phone calls and visits might be better"

"With online tools"

Shared responsibility
"Could be better ways, or more ways; it is very connected to the holistic overview (Step 2) Not sure if these two steps should be or are separate steps actually… But that is a whole other discussion!"

"I just think it is important to have everyone involved from the beginning co-design. To me, it´s the best way you can achieve a successful sustainable product."

"I'm not sure on this step because in my experience, designers are not necessarily involved throughout the project (for example they leave after prototypes finished). Therefore, the company has the responsibility (also ownership) to continue (or not) the project according to their own requirements (instead of external partners)."

11.3 AN ALTERNATIVE FRAMEWORK FOR VALIDATION

Our theoretical perspective, critical realism, holds there is a single reality, which each of us interprets, understands and conceives differently (Sage, n.d.). We therefore share positivism's assumption of a single reality, while simultaneously resonating with interpretivism's appeal for a deeper, context-specific understanding of reality. While we agree with positivism on the importance of validity (Mackenzie & Knipe, 2006), we also agree with interpretivism's call for alternatives to the traditional quantitative researchcentric validity standards for judging the quality of context-specific research (Trochim, 2006). Therefore, we adopt four criteria developed by Lincoln and Guba's (1985) (Fig. 11.34), which are analogous to quantitative validity criteria.

TRADITIONAL CRITERIA TO JUDGE QUANTITATIVE-ORIENTED RESEARCH	ALTERNATIVE CRITERIA TO JUDGE QUALITATIVE-ORIENTED RESEARCH
Internal validity	Credibility
External validity	Transferability
Reliability	Dependability
Objectivity	Confirmability

Figure 11.34: Alternative criteria to judge the soundness of qualitative-oriented research by Lincoln and Guba (1985)

CREDIBILITY

Credibility corresponds to positivism's criterion of internal validity, which seeks to check whether the study actually measures or tests what it intends to (Shenton, 2004). Credibility is key to establishing the research's trustworthiness (Lincoln & Guba, 1985), and asks how congruent the findings are with reality (Merriam, 1998). We took several of the steps identified by Shenton (2004) to ensure the credibility of our research. These are listed as below:

Using established research methods

We adopted research methods (discussed in 2.3) which have been effectively used in design science research and also in the field of action-research in the development sector. In addition, we sought to use operational measures which were suitable for the concepts we were studying (Yin, 1994). Since our research centered on holistically sustainable design and innovation, we used several mechanisms commonly used in this sphere—including workshops for product development and consultations with different stakeholders from the production-to-consumption system.

Familiarity with scenario and respondents before data collection

We familiarized ourselves with the scenario and respondents before data collection, through the second phase of our research—the review of background material (2.3) (Shenton, 2004). In addition to this, we visited, studied and created research-dissemination material, which contributed to the familiarization process. We interacted with the Kotwalia community and created a scoping study for NABARD (which forms the basis for Chapter 7) and studied the design reports of three design students who worked with this community to understand designer–Kotwalia interactions. We had been working with this community and with design students through our academic and professional consultancy. This prolonged engagement (Lincoln & Guba, 1985) earned us credibility in this area (Patton, 1990), which added to the credibility of the research. To ensure that our long-term engagement did not color our professional judgment (Lincoln & Guba, 1985), the workshop in India was co-conducted with three other facilitators, the questionnaire in Vietnam was administered by another researcher, and the final questionnaire was administered via e-mail.

Triangulation
We used different methods to collect data, thereby, allowing for triangulation and reducing the limitations of each method and exploiting their respective benefits (Brewer & Hunter, 1989; Guba, 1981). We have discussed the different approaches we used for triangulation—including data, investigator and methodological triangulation—and member checking, which is key to increasing the credibility of research in 2.4 (Lincoln & Guba, 1985). We used a wide range of informants (Shenton, 2004)—Indian respondents, Vietnamese respondents and international respondents—and were therefore able to check information across these groups (van Maanen, 1983). Taking data from these three groups across time- and space-lapses also allowed for site triangulation, allowing us to get a holistic view of the *reality* across different perspectives in time-space (Devin, 1983). We hope the similar results which emerged at these three sites give greater credibility to our findings in the eyes of the reader.

Tactics to help ensure honesty from respondents
Each of our questionnaires mentioned that—*There are no right or wrong answers to these questions*—in order to encourage respondents to be honest (Brewer & Hunter, 1989; Guba, 1981).

Discussions and scrutiny
Our strategy, progress and findings were continually discussed with the three promoters of this thesis, which widened our vision. In addition, the inherently dynamic nature of design-science research meant that we had several discussions with a cross section of people—including scholars, practitioners, and craftspeople—who helped us recognize our biases and preferences (Shenton, 2004). We also presented our research at different forums—including through presentations, conferences, lectures, and publications—which allowed for peer scrutiny (Shenton, 2004).

TRANSFERABILITY

Transferability corresponds to positivism's criterion of external validity, which seeks to ascertain the extent to which the findings of a study can be generalized to other situations (Merriam, 1998). The prospect of transferability in the case of qualitative research seems to be fundamentally flawed, given that findings are shaped by the specific contexts in which they occur; claiming that results from a setting can be applicable to another cannot be done with certainty (Eraldson et al, 1993). However, we agree with Stake (1994) and Denscombe (1998) who argue that though each case is unique, it is also an example within a broader group—such as in the case of our broad problem context, which encompasses all three of the settings from where we derive findings.

Assessing transferability is best done by practitioners who can assess the proximal similarity of their situation to that described in the study, and thereby the transferability of the findings to their setting (Bassey, 1981). Accordingly, we assessed the transferability of our findings by face-validity exercises, where the respondents/readers gave their opinion on transferability based on contextual information we provided to them through our presentation (Vietnam group) and YouTube video (international group). The researcher is responsible to ensure they provide sufficient contextual information—such as that we have provided in Chapters 7 and 10, and also in the presentation (Vietnamese group) and YouTube video (international group)—to the reader to make such a judgment (Lincoln & Guba, 1985). Assessing transferability could best be done by conducting similar projects using the same methods in different environments, and while this is beyond the scope of our current research, we see this as an avenue for future research. One of the respondents from Mexico offered to trial the Rhizome Approach in his location as a case study (Rivas, 2016), which suggests transferability. The interest from different institutions in Vietnam to operationalize and adapt the sustainability framework is discussed at length in the following chapter, and also suggests transferability.

DEPENDABILITY

Dependability corresponds to positivism's criterion of reliability, which seeks to ascertain whether we would get the same results if we could repeat the experiment exactly (Shenton, 2004). As discussed in this chapter, it is impossible to test this in the case of qualitative research such as ours, since recreating the experiment is not possible given changing contexts. The idea vis-à-vis dependability is therefore to view and report on the research design as a prototype model (Shenton, 2004), which can be recreated in a proximally similar manner by future researchers, who may get proximally similar results. This is very much in line with the design science research process, which inherently works on the premise of a prototype that gets refined over subsequent iterations. In order to facilitate this, researchers should share their research design including rationale and implementation plan (as we did in Chapter 2), detailed description of implementation (as we did through our *thick* descriptions in Chapter 10 and also through our other publications centering on the workshop), reflective appraisal of the project (which we offer in the last chapter) and also evaluating the effectiveness of the process of inquiry undertaken (which we did on a regular basis through discussions with the promoters of this PhD thesis). An additional factor is demonstrating credibility—including through the methods we discussed above with regards to the credibility of our research—which naturally ensures dependability (Lincoln & Guba, 1985).

CONFIRMABILITY

Confirmability corresponds to positivism's criterion of objectivity, which seeks to ascertain the extent to which the results could be independent from researcher bias and be corroborated by others (Trochim, 2006). We have already discussed how we dealt with the aspect of objectivity in 2.4 under the subheading, *Subjectivity and the Role of the Researcher*. Quantitative research deals with this issue by using instruments that are not dependent on human perception. In a similar vein, we gathered data through questionnaires to reduce researcher bias (Patton, 1990). However, questionnaires are designed by humans, and so the researcher's biases will be reflected even in their design. Triangulation has been outlined as a way to reduce the investigator bias and has been discussed in this chapter and also in Chapter 2. A second factor is the admission of the researcher's beliefs and assumptions (Miles & Huberman, 1994); we discussed our ontology in Chapter 2 to throw light on our underlying beliefs. The third factor is recognizing shortcomings in the methods and their potential effects. Towards this end, we exposed each step of the Rhizome Approach to scrutiny by 15 designers around the world, who suggested alternative approaches and pointed out weaknesses in the techniques employed (11.2). Finally, a detailed methodological description which enables scrutiny of how the data has shaped constructs and also the evolution of the constructs helps ensure confirmability (Shenton, 2004). In our research, an audit trail was carefully created to allow the reader to trace the evolution of constructs such as the Rhizome Approach in a diagrammatic manner (Shenton, 2004). Further information to supplement the audit trail is contained in annexures, and also in supporting publications.

11.4 SUMMARY AND CONCLUSIONS

This chapter explored the transferability of the findings from the workshop to the broader set of those in the problem class delineated by this design science research (Venable, 2009)—designers working with developing-country MSMEs with renewable materials. Since the problem class was so broad and diverse, we could not aim to go the way of quantitative research, i.e., to reproduce the lab environment (the workshop settings) and ensure ecological validity in order to check generalizability. Neither was it our intention to do so, since we designed the Rhizome Approach to be a flexible set of steps which can be adapted to each specific setting in the range of the broad problem class. Instead, we adopted Lincoln and Guba's (1985) criteria to check the soundness of qualitative research, and focused on transferability to settings within the gradient of similarity of our problem class.

The first phase to check these factors was conducted in Vietnam by administering two questionnaires to 21 trainers from the SPIN project. Some of the key conclusions from this phase as listed below:

• The relevance of the seven barriers which underpin the Rhizome Approach was ascertained by asking the participants whether these barriers hindered them from designing sustainably. The findings indicate that the barriers which underpin the Rhizome Approach are indeed relevant to the context of Vietnamese MSMEs.
• Compared to the Indian respondents more Vietnamese respondents could understand the Sustainability Checklist just by reading it, suggesting that the overall the Vietnamese respondents understood the checklist more easily at first—possibly because they had already received inputs in sustainable innovation from the SPIN project. However, a higher percentage of them as compared to the Indian respondents could not understand all the factors even after the explanation as compared to the Indian respondents. A possible reason for this could be unfamiliarity with English. This hypothesis is supported by the fact that the Vietnamese respondents cited the Sustainability Checklist being supported by an explanatory booklet as the primary factor which would make them more likely to use it. The percentage of Indian respondents who answered the same (17%) is much lower than the Vietnamese respondents (76%).
• The Vietnamese respondents had a stronger response to using the Sustainability Checklist both with regards to a positive and negative response as compared to the Indian respondents.

• Other than the factors in the Sustainability Checklist itself—shorter, digital, better-looking, etc.—the most cited factors which would make the respondents likely to use the checklist were peer pressure, client demand and, lastly, government legislation.
• There was an increase in familiarity with concepts relating to sustainability following the presentation, which indicates that the inputs on the Rhizome Approach were effective even when compressed. The degree to which the mode of delivery impacted a change in knowledge levels is an interesting avenue of further research, but beyond the scope of our immediate research.
• The findings on familiarity with concepts relating to sustainable design seem, surprisingly, to indicate a knowledge loss following the presentation. One possible explanation is that the inputs from the presentation helped participants realistically and critically evaluate the extent of their knowledge gap with regards to concepts relating to sustainable design. However, we feel that this finding merits further research.
• The presentation on the Rhizome Approach helped increase the knowledge on Ecodesign and Triple Bottom Line sustainability models.
• Following the presentation, there was a rise in the percentage of participants who felt ecological, cultural, economic and political aspects should be considered while designing sustainably. The perception on the social factors remained constant, whereas their perception that the ethical and political factors are important to sustainable design decreased. This seems to indicate the respondents' acceptance of the Four Pillars model.
• Before the presentation, most of the participants cited environmental factors—preservation, pollution reduction, and global warming—as aims of sustainable design. The economic factor or increasing business and sales was the factor that was cited by the second largest majority. Social factors were cited above cultural factors. The percentage of respondents who cited each factor dropped following the presentation, except in the case of reducing pollution which remained constant. These findings are contradictory to what was expected and our immediate research cannot explain them.

The second phase to check transferability was conducted by administering an e-questionnaire to 15 designers located across Africa, Australia, Europe, Latin America, Turkey and Southeast Asia. Some of the key conclusions from this phase as listed below:

• One respondent suggested the Rhizome Approach should build upon existing indigenous knowledge. This was a positive reinforcement, since the Rhizome Approach already does this by documenting and culling out contemporary design markers from indigenous knowledge through the product-library workshop which is part of Step 4 of the Rhizome Approach.
• Several of the respondents suggested digital tools. In line with this feedback, in the next iteration, the Sustainability Checklist was developed into software for ease of operation. This is discussed in the next chapter.
• Providing background information to the designers was suggested as a practical way to provide inputs. This factor is inherent in Step 1 which centers on didactic learning.
• Some of the respondents suggested that hands-on learning/learning-by-doing would be a good way for designers to learn. Step 2 of the Rhizome Approach addresses this aspect and centers on experiential learning.

• Collaborative learning was also cited as an important aspect of sustainability innovation. We address this in Step 5 of the Rhizome Approach. Further feedback was to outline the involvement and role of each member of the design team vis-à-vis sustainability and innovation. This is an interesting proposal and could add to the process.
• Some of the respondents suggested a framework that is simultaneously adaptable and measureable. The Rhizome Approach addresses this already through the flexible and adaptable Sustainability Checklist used in Steps 4 and 6. In addition, one respondent suggested further flexibility through the possibility of conducting the steps independently. This is in line with our vision of the steps of the Rhizome Approach as being both independent and interdependent (Chapter 9).

Designers maintaining ownership of the process—including through incentives, legislation and peer pressure—as a means of increasing the use of the Rhizome Approach (Research Question 3), was one of our conclusions. We partly addressed the issue of ownership in Step 7 of the Rhizome Approach, where we look at keeping the designer onboard until final product actualization. As this is an important input into Research Question 3, we look at this further in the following chapter.

Based on the validation of the soundness of our research against the criteria developed by Lincoln and Guba, (1985) and also the feedback on the transferability and expected efficacy of the Rhizome Approach from the phase in Vietnam in 2011 we concluded that we had successfully answered Research Question 2: The Rhizome Approach is a possible sustainability design approach that is mindful of the pros and cons of the existing sustainability design approaches, and which looks at addressing an integrated holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries. This conclusion was supported by the findings from the questionnaire administered to 15 designers around the world in 2016. We therefore proceeded to answer the final research question—What mechanisms would support and encourage the use and operationalization of any possible sustainability-design approach that might be developed in response to Research Question 2? The following chapter discusses our process to answer to this question, and the outputs and findings thereon.


UNIDO
Chương trình chung Sản xuất và Thương mại Xanh
Joint programme on Green Production and Trade
HỘI THẢO
HO HOẠT ĐỘNG XÂY DỰNG THƯƠNG HIỆU
THỦ CÔNG MỸ NGHỆ VIỆT NAM
OPERATIONALIZATION OF BRANDING HANDICRAFT FOR VIETNAM
Hanoi, 21st November, 2012


ECOLOGICAL SUSTAINABILITY
SOCIAL SUSTAINABILITY
CULTURAL SUSTAINABILITY
ECONOMIC SUSTAINABILITY
IND ★★★
Assessed for Holistic Sustainability


ECOLOGICAL SUSTAINABILITY
SOCIAL SUSTAINABILITY
CULTURAL SUSTAINABILITY
ECONOMIC SUSTAINABILITY
ECOLOGICAL Cleaner materials and process, energy efficient
SOCIAL Fair-trade and labour, safe for makers and users
CULTURAL Supports local culture and indigenous knowledge
ECONOMIC Supports livelihoods and local trade
IND ★★★
Assessed for Holistic Sustainability


SOCIAL SUSTAINABILITY
CULTURAL SUSTAINABILITY
ECONOMIC SUSTAINABILITY
ECOLOGICAL SUSTAINABILITY
IND
Assessed for Holistic Sustainability

12 THE HOLISTIC SUSTAINABILITY SYSTEM

The previous chapter centered on examining the soundness of our theory. The findings and conclusions from this phase indicated that we had successfully answered Research Question 2: The Rhizome Approach and its constituents—especially the Sustainability Checklist—comprised a sustainability design approach that is mindful of the pros and cons of preexisting sustainability design approaches, which also looks at addressing an integrated holistic picture of sustainability in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries. We therefore proceeded to address the final research question: What mechanisms would support and encourage the use and operationalization of any sustainability design approach that might be developed in response to Research Question 2, i.e., the Rhizome Approach and its constituents?

Like most of approaches and tools addressing sustainability in a less or more holistic manner—including as LCAs, rules of thumb and checklists—the Rhizome Approach aims to factor sustainability concerns into the product design-and-development process (Boks, 2006; Bovea & Pérez-Belis, 2012; Brezet & van Hemel, 1997). Our inquiry into why the interest in sustainability and sustainable design (Fuad-Luke, 2009) has not translated into frequent practice by designers (Aye, 2003; Hankinson & Breytenbach, 2012; Kang et al, 2008; Kang & Guerin, 2009; Mate, 2006) (4.5) identified seven meta-barriers—only one of which was the lack of tools. The mere existence of tools which aim to address sustainability exist—such as our Rhizome Approach—does not automatically mean that sustainability factors will be integrated into the product-development process (Huulgaard, 2015). Recent literature on sustainability design highlights the importance of softer aspects—including organizational structures, and systems and competence building—which are not obviously and directly linked to the product development-and-design process, but support the implementation and use of sustainable design tools (Boks, 2006). Research Question 3 therefore centers on mechanisms which can support and encourage the use and operationalization of the Rhizome Approach, and its constituents.

In order to explore the answer to this question, we studied the immediate envelope within which the designer works—the company—in terms of its sustainability journey and sustainability drivers. This is discussed in 12.1. We discuss the mechanisms which can influence these drivers and selected potentially suitable mechanisms for our problem class in 12.2.

Since we did not find an existing mechanism which suited our problem class, we decided to identify and iteratively develop a mechanism which would support and encourage the use and operationalization of the Rhizome Approach through empirical research. In order to do this, we selected a real-time problem context, which represented the problem class of our research (12.3). Based on the findings and interest vis-à-vis the Sustainability Checklist which is at the heart of the Rhizome Approach—and our shortlisting of the mechanism best suited to our problem class in 12.2—we decided to operationalize the Sustainability Checklist through a branding and labeling scheme.

Section 12.4 discusses the final design-and-development phase where the Sustainability Checklist was refined in a participatory manner for UNIDO's branding initiative in Vietnam, and a labeling and certification system was developed to support its operationalization. In 12.5, we discuss how the feedback from the two groups discussed in 12.4 was incorporated, and tested through feedback from a third group.

In 12.6, 12.7 and 12.8, we discuss the final design of the standard-setting, certification, and labeling, respectively.

Finally, 12.9 offers a summary and conclusions on how the second iteration of the checklist and the branding and labeling scheme to support it answers Research Question 3.

12.1 THE COMPANY: ITS IMPORTANCE, SUSTAINABILITY JOURNEY AND SUSTAINABILITY DRIVERS

Designers are brokers who introduce new practices in or between communities by encouraging and facilitating communication between individuals, institutions and functions (Wenger, 1998). The artifacts they design—including approaches such as the Rhizome Approach, and the products that result from its application—act as boundary objects, which carry information that can be transferred, translated and transformed in (Wenger, 1998) or between (Hargadon, 2002; Keskin et al, 2013; Küçüksayraç, 2015; O'Rafferty & O'Connor, 2010) communities. This factor, alongside the increasing scope, role, and power of designers around the world, positions them as key players in strategic decisions, which will determine production-to-consumption systems, and thereby sustainability, globally (British Design Council, 2004; Swedish Design Industry, 2004). However, in order to design these artifacts, designers need to be supported to navigate—and thereby be able to impact—the complex and interlinked levels of society (Jørgensen, 2012) including the incremental levels from product-technology system, to product-service system, to socio-technical system to societal system (Joore & Brezet, 2015).

In several cases, the immediate outside envelope which impacts designers' practice of sustainability design—and from where support needs to come—is the company or organizational framework within which the designer works. The discussion on Barrier 3 of the Rhizome Approach—failure to include sustainability at a strategic level in the overall approach—reveals that designers are often demotivated from practicing sustainable design because of companies' resistance towards investing in it (Bacon, 2011).

Our literature review (4.3) identified three main drivers for sustainability—regulatory and non-regulatory frameworks, market demand and access (Cleff & Rennings, 1999) and sustainability as a business opportunity and USP (Rubik & Frankl, 2005). Further analysis in the same chapter revealed that these drivers tend to move from external/stick to internal/carrot over the course of a company's sustainability journey (Cleff & Rennings, 1999). The company's initial preoccupation with compliance to regulatory and non-regulatory frameworks (external/stick) shifts towards leveraging sustainability to cut costs, to finally using sustainability as a value-addition factor to tap larger markets and increases business opportunities (internal/carrot) (White et al, 2008). Willard (2002) identifies five stages of a company's sustainability journey (Fig. 12.1), which corresponds with the Scottish Environment Protection Agency's 6C typology for environmental behavior—which classifies regulatees into criminals, chancers, careless, confused, compliant and champions.

STAGE	1 PRE-COMPLIANCE	2 COMPLIANCE	3 BEYOND-COMPLIANCE	4 INTEGRATED STRATEGY	5 PURPOSE/ PASSION
BEHAVIOUR	• Actions are unsustainable and illegal	• Actions fulfill bare minimum legal obligations	• Saves money by reducing by increasing efficiency to reduce unsustainability	• Includes sustainability in business strategies • Sustainability = business opportunities and competitive advantages	• Uses business as a vehicle to create holistic sustainability to benefit their business opportunities
	EXTERNAL/ STICK ⟵			⟶ **INTERNAL/ CARROT**	

Figure 12.1: The stages of a company's sustainability journey as identified by Willard in 2002 (Reubens 2016)

Innovations towards sustainability produce double externalities. There are positive consequences or externalities, in both the innovation and diffusion phases in the form of know-how and positive impact on sustainability, respectively (Cleff & Rennings, 1999; Beise & Rennings, 2005). While the investment in developing the innovation is borne by the company, the fruits of this investment are also leveraged by their competitors, especially if the know-how is easily accessible and if the eco-innovation is for the public good (Beise & Rennings, 2005). This discourages companies from pro-actively investing in sustainability design. This situation resonates keenly with the MSME sector, whose low-tech processes, protocols and innovations are relatively easy to copy. Additionally, MSMEs do not have deep pockets and need to capitalize upon all of the investments they make—including those for sustainability—making mechanisms to keep them on the sustainability track important. Mechanisms that create a push–pull effect—including through regulation (Rennings, 2000)—can play a vital role in encouraging companies to remain on the sustainability track.

12.2 MECHANISMS WHICH CAN INFLUENCE SUSTAINABILITY DRIVERS

Literature reveals four main types of mechanisms—a) hard regulation instruments, b) soft regulation instruments, c) economic instruments, and d) communicative instruments—which have been used to influence the drivers of sustainability discussed in the last section, thereby encouraging company and consumer behavior towards sustainability. We discuss these mechanisms and compare them side by side in Fig. 12.2. As in the case of the companies' sustainability journey, there has been a shift from stick to carrot in the case of these instruments. The popularity of hard instruments (stick) has been waning since the 1980s and there has been a subsequent emergence of economic, communication instruments (Huulgaard, 2015) and soft instruments (carrot).

HARD REGULATION INSTRUMENTS	SOFT REGULATION INSTRUMENTS	ECONOMIC INSTRUMENTS	COMMUNICATIVE INSTRUMENTS
Command and control or hard instruments focus on policing, controlling and removing activities which are undesirable from the perspective of sustainability (Huulgaard, 2015).	Soft regulation instruments are used in situations when traditional hard instruments are not necessary. They are more flexible in practice than hard instruments.	Economic instruments are market-based policy devices focus on influencing sustainable behavior through price signals as opposed to policing (Hockenstein, Stavins, & Whitehead, 1997). They work on the principle that if the most sustainable product or service is the cheapest, it will be preferred over the more expensive unsustainable one (Winsemius, 1986).	Communicative instruments are non-mandatory or soft instruments (Cleff & Rennings, 1999), which focus on influencing consumer- and company-behavior through information and education (Smith, 2002).
They work on the principle of policing.	They work on the principles of self-regulation and co-regulation, technical standards, recommendations, open methods of coordination and their hybrids (European Commission, n.d.).	They work on the principle of incentives.	They work on the principle of communication.
These create a push for companies to meet minimum compliance, e.g., Ecodesign Directive.	These create a pull for companies to behave sustainably by awarding them legitimacy in a non-mandatory framework.	These create a pull for companies to behave sustainably by incentivizing them, e.g., energy label.	These create a market pull, which motivates companies to behave sustainably to get more business.

HARD REGULATION INSTRUMENTS	SOFT REGULATION INSTRUMENTS	ECONOMIC INSTRUMENTS	COMMUNICATIVE INSTRUMENTS
Examples of command and control instruments include regulations that set specific standards for product improvement such as the RoHS (Restriction of Hazardous Substances) Directive (2011/65/EU).	Examples of soft instruments include recommendations, technical standards, self-regulation (voluntary standards) to legislation-induced co-regulatory actions (European Commission, n.d.).	Examples of economic instruments include pollution charges, subsidies, deposit–refund systems (Bailley & Ditty, 2009; Sridhar, 2011; United Nations Environment Programme, 2005), taxes and tradable permits (Cleff & Rennings, 1999).	Examples of communicative instruments include eco-labels and voluntary agreements between industry and government (Cleff & Rennings, 1999).
Incentives for improvement disappear once standards are met unless standards are consistently reviewed and raised.	The legitimacy of this system needs to be maintained by addressing issues of transparency, and a credible system to ensure compliance with commitments. Also importance is to work out financials to ensure the sustainability of the instrument (European Commission, n.d.).	These can lead to short-term behavioral changes, however, longer-lasting changes need the motivation to come from within the individual and not from an outside force (Pape, Fahy, & Davies, 2011).	Providing access to accurate information needs to be coupled with incentives in order to create change (Pape et al, 2011).

Figure 12.2: Characteristics of hard, soft, economic and communicative instruments and a comparison between them (Reubens 2016)

Figure 12.3 depicts which instruments are most relevant at the different stages of a company's sustainability journey and the role of the regulator based on Angus et al's (2013) analysis of suitable policy instruments based on firms' characteristics and our understanding from Fig. 12.2.

STAGE	1 PRE-COMPLIANCE	2 COMPLIANCE	3 BEYOND-COMPLIANCE	4 INTEGRATED STRATEGY	5 PURPOSE/PASSION
INSTRUMENTS	• Hard regulation instruments	• Economic instrument • Hard regulation instruments	• Economic instrument • Soft regulation instruments	• Communicative instrument • Soft regulation instruments	• Communicative instrument • Soft regulation instruments
ROLE OF REGULATOR	• Monitor and prosecute	• Set outcomes • Educate and advise on sustainability issues • Audit performance	• Set outcomes • Audit performance	• Set outcomes • Audit performance	
		• Enforce incentives where necessary	• Enforce incentives where necessary	• Recognize and publicize success	• Recognize and publicize success
EXTERNAL/ STICK ◄──► INTERNAL/ CARROT					

Figure 12.3: Instruments which are most relevant at the different stages of a company's sustainability journey based on Willard (2002) and Angus et al's (2013) analysis (Reubens, 2016)

The Rhizome Approach was designed to facilitate holistically sustainable design in the case of our problem class—non-industrial craft-based MSMEs working with renewable materials in developing countries. The low priority of environmental sustainability in the developing world is reflected in the poor environmental enforcement, against the backdrop of the realities of corruption and favoritism as a means of bypassing existing nascent legislation systems (Bell & Russel, 2002). The key elements for regulatory instruments to function—including accurate monitoring, a working legal system and transparency—are largely missing in the developing world (Bell & Russel, 2002). Therefore, for the most part, the driving factor for the developing-world MSMEs in our problem class to invest in sustainability design is the market, rather than existing legislation or financial incentives. Accordingly, the MSMEs that invest in sustainability design and innovation in our problem class generally fall under the Categories 4 and 5 of Fig. 12.3. The corresponding instruments for this stage—which could support and encourage the use and operationalization of the Rhizome Approach—are communicative and soft regulation instruments.

RATIONALE TO SELECT LABELING

We reviewed different types of soft regulation and communicative instruments (Laurell, 2014), especially, the numerous forms of self-regulatory instruments which have emerged over the past decade targeting environmental protection—including sectoral guidelines, codes of practice, covenants, environmental management systems, customer and supplier requirements, environmental accounting, environmental auditing, environmental charters, environmental management systems, public reporting requirements, and eco-labeling

(Andrews, 1998; Borkey et al, 1999; Carmin et al, 2003; Jordan et al, 2005; Mazurek, 2002; Nash & Ehrenfeld, 1997; Sinclair, 1997). We selected labeling from among these for four main reasons. Firstly, labeling spans the categories of both communicative and soft regulation instruments. Labeling consists of three basic steps—a) standard-setting, b) certification, and, c) communicating the results of the assessment (Cassell & Symon, 2006). While Steps 1 and 2 align with soft regulation instruments, Step 3 aligns with communicative instruments. Secondly, labeling spans the range between the mutually exclusive approaches of hard command-and-control regulation, and soft voluntary self-regulation. It can lean towards either, depending on the strictness of the implementation of major aspects of labeling policy—compulsoriness, explicitness and standardization (Mil-Homens Loureio, 2011). Thirdly, especially in the environmental arena, labeling emerges as a third generation of regulatory instruments which offer the possibility of self-regulation under state supervision—where the state goes beyond punishing through prescriptive legislation, to encouraging top performers to go beyond compliance by rewarding them (Mil-Homens Loureio, 2011)—thus promoting a cooperative relationship with businesses (Clinton, 1995). The fourth reason to select labeling was that it is a management-based mechanism (also known as process- or systems-based regulation) which encourages firms to self-regulate and plan towards achieving broader societal objectives (Coglianes & Nash, 2004). As opposed to technology-based mechanisms, which target the manufacturing stage by outlining specific processes or technologies to be used), and performance-based mechanisms which target the output stage by specifying outcomes to be met (Coglianese, Nash, & Olmstead, 2003), management-based mechanisms target the planning stage (Coglianese & Lazer, 2003), which is in line with our argument for front-end innovation which factors in larger sustainability goals (4.2).

RATIONALE TO DEVELOP A NEW CERTIFICATION AND LABELING INITIATIVE

Currently, there are estimated to be more than 400 sustainability-aligned certification and labeling schemes spanning almost every category of consumer products, and this number is projected to be increasing rapidly (Stewart, 2010). We reviewed some of the most recognizable green labels (Stewart, 2010) to check if they could provide an answer to Research Question 3, but found that none of these addressed sustainability in a holistic manner (Fig. 12.4). All except one of the thirty-two labels reviewed focused on the ecological dimension, and only four focused on the social and/or economic dimensions. None of the labels reviewed focused on the cultural dimension.

SR. NO.	LABELLING SCHEME	ECOLOGICAL	SOCIAL	ECONOMIC	CULTURAL
1	FSC Certified	●			
2	SCS Certified Cal Compliant	●			
3	Rainforest Alliance Certified	●			
4	Processed Chlorine Free and Totally Chlorine Free	●			
5	Energy Star	●			
6	Dark Sky	●			
7	Lighting Facts	●			
8	Energyguide	●			
9	Watersense	●			
10	LEED	●			
11	BREEAM	●			
12	CRI Green Label and Green Label Plus	●			
13	Smart Certified	●			
14	Floor Score	●			
15	Level	●	●		
16	SCS Certified Indoor Advantage	●			
17	Certified Humane Raised and Handled	●			
18	Fair Trade Certified		●	●	
19	Certified Veliflora Sustainably Grown	●	●		
20	Animal Welfare Approved	●			
21	Whole Trade Guarantee	●	●	●	
22	USDA Organic	●			
23	Leaping Bunny Cruelty-free	●			
24	Dolphin Safe	●			
25	SCS Certified Recycled Content	●			
26	UL Environment	●			
27	Ecologoy	●			
28	Green Seal	●			
29	Green E	●			
30	Cradle to Cradle	●			

Figure 12.4: Review of 32 recognizable green labels (Stewart, 2010) vis-à-vis the dimensions of sustainability they address (Reubens 2016)

Literature confirms that most existing sustainability labeling schemes seem to focus on environmental or social aspects (Frankl, Pietroni, Scheer, Rubik, StØ, & Montcada, 2005), with sometimes an explicit contradiction between the two foci (Harris, 2007). The rarity of schemes which integrate the ecological, social and economic dimensions of sustainability and social metrics (Seuring & Muller, 2008) seems to be corroborated by the recent calls from government actors (Baedeker et al, 2005; IEFE & ICEM CEEM, 1998; Mazijn et al, 2004; Sustainable Development commission, 2008; Teufel et al, 2009) and academics

(Eberle, 2001; Eckert et al, 2007; Frankl et al, 2005) for current schemes to address more dimensions than they currently do, and also for an overarching meta-sustainability label which integrates the different dimensions of sustainability (Hayn & Eberle, 2006). Dendler (2013) identifies existing schemes which look at multiple dimensions, such as UK NGO Sustain's (2007) multiple-criteria flower label for food; German retailer REWE's PRO PLANET labeling (n.d.) which looks at premium-quality products that are both ecologically and socially sustainable, and a Swedish organic eco-labeling organization's label which looks at integrating climate change and sustainability issues. However, none of these schemes address all four dimensions of sustainability, nor do they address the cultural factor that is very important to handicraft-sector MSMEs in the developing world.

The existing labeling schemes in the handicraft sector that we reviewed did not address sustainability holistically either. Several of the schemes looked at the cultural and social dimension through region-specific labeling such as the Craftmark of the All India Artisans and Craftsworker Welfare Association, which certifies that handicraft products are genuine and produced in a socially responsible manner (Craftmark, n.d.), or India's Geographical Indication (GI) tag for region-specific crafts such as Patan Patola textiles or Chennapatna lacquer toys, which identifies and attributes a products quality or distinctive characteristics to its geographical origin thus recognizing and protecting craft's intellectual property (Intellectual Property India, n.d.). In a similar vein, there are several large and small labeling schemes which state the product is *handmade in* a specific region, such as the Laotian local handicraft label *Handmade in Luang Prabang* (International Trade Center Communications, 2013).

Some handicraft-sector labeling schemes seem more focused on the socio-economic dimension—such as the World Fair Trade Organization's on-going initiative, which looks at certification, monitoring and labeling scheme for fair-trade labeling of craft (Hall, n.d.). Sometimes, the focus is predominantly social, such as the GoodWeave (2014) label, where an NGO certifies that carpets in India are not produced using child labor. Morocco's 2013 national handicraft label factors in both environmental and social criteria (Sustainable Business Associates, n.d.).

We argue that showcasing an integrated picture of the four dimensions is very important in general, and particularly in the case of the handicraft sector (Seuring & Muller, 2008). This is because the handicraft sector impacts all of the dimensions of sustainability, especially the social and cultural dimensions. As discussed earlier, our literature review could not identify an existing eco-labeling scheme which was holistic; nor did current schemes being used in the handicraft sector target sustainability holistically. Therefore, we proceeded to develop a labeling scheme and the mechanisms to underpin it, through a second cycle of design and development, to answer Research Question 3. The overall intent of this labeling scheme was to showcase the sustainability achieved holistically, so that sustainability-branded products are genuinely better on all four key dimensions: environment, social, cultural and economic. The proposed tool would center on refining the Sustainability Checklist—which is at the heart of the Rhizome Approach—and its evaluation mechanism used in Step 6 (10.3). As in the previous design-and-development cycle, we sought to develop and test our intervention in a real context (van den Akker, 1999) and improve it (Plomp, 2009) iteratively;

in the process, generating theory that would be applicable beyond the intervention scenario, to a larger set of individuals and institutions in the generalized problem class (Venable, 2009). This subset would be representative of the larger audience that this design science research aims to address: craft-based MSMEs in developing countries working with renewable materials, which were linked to designers.

12.3 UNIDO'S BRANDING INITIATIVE: THE PLATFORM FOR ITERATION CYCLE 2

Our literature review and analysis, in the previous section, indicated the answer to Research Question 3: Communicative and soft regulation instruments, and labeling in particular, would be best suited to support and encourage the use and operationalization of the Rhizome Approach and its constituents, in the case of non-industrial craft-based MSMEs working with renewable materials in developing countries.

We selected UNIDO's branding initiative in Vietnam—under the Joint Programme on Green Production and Trade to Increase Income and Employment Opportunities for the Rural Poor—as a platform for Iteration Cycle 2 of our research. The initiative was a culmination of UNIDO's support to Vietnamese MSMEs from five handicraft value chains—bamboo/rattan, silk, sea-grass, handmade paper and lacquer-ware—in the area of cleaner production and sustainable product design. Several of these MSMEs now had green and commercially-viable products in place. UNIDO aimed to put in place a branding initiative which would help differentiate these products and translate their investment in sustainability into economic benefits. This, in turn, would provide an impetus for these MSMEs to continue on the path to sustainability. We were professionally linked to the initiative through our consultancy for UNIDO.

The reasons selecting UNIDO's branding initiative are as below:
- The initiative's mandate resonated with Research Question 3
- UNIDO's initiative was a suitable platform to address Barriers 3, 4 and 6 to sustainability design (3.5), which link into Research Question 3. These barriers indicated that the additional cost involved in sustainability design needed to translate into realizable value for companies to invest in and demand sustainability design.

REDEFINING THE BRIEF: FROM GREEN TO SUSTAINABILITY-ALIGNED

UNIDO originally planned to showcase the project achievements through a *green* brand, which it expanded to a *sustainability-aligned* brand based on our inputs. Our reasoning for this was that the achievements of this handicraft sector project expanded beyond the environmental dimension, and included socio-economic and cultural aspects as well. This is because (as argued throughout this thesis) these products provided employment to local producers in both actual production, as well as producing input materials for production—thus contributing to livelihood security and more equitable value chains (socio-economic sustainability). Since these handicraft products were produced within the traditional craft village set-up characteristic of Vietnam's cultural industry, they also help vitalize and sustain the local culture (cultural sustainability). This expansion of scope is relevant as it reinforces our argument that handicraft production-to-consumption systems can be leveraged as a vehicle to impact sustainability in a holistic manner, through design.

UNDERPINNING THE BRANDING INITATIVE WITH A LABELING SCHEME

We decided to underpin the branding initiative with a labeling scheme in order to provide legitimacy to the proposed brand. The need for legitimacy was identified through our background research, which revealed consumers' skepticism of *green* or *sustainable* products which did not substantiate their claims (Golden, 2010). The highest degree of success in green or environmental branding has been with nondurable, frequently used, and highly visible consumer goods (Gallsategui, 2002), whose standardized manufacturing processes are easier to examine and measure. The comparatively informal nature of the handicraft sector is not conducive to similar scrutiny, making it difficult to transfer this experience from the industrial sector (Reubens, 2013). Therefore, we decided to work towards a transparent, accountable and inclusive labeling scheme, specifically for the handicraft sector, which would instill rather than undermine confidence and credibility of the brand to be developed. At the highest level, the brand would align with Vietnam's national branding initiative *Value from Vietnam* adding to the credibility of the brand. The other reason for the labeling scheme was these are among the most prominent measures to facilitate sustainable production and consumption (Dendler, 2012), which was one of UNIDO's goals which dovetailed with the aims of our research.

The labeling scheme comprised three basic steps:
1. Standard-setting, or identifying criteria to be met
2. Certification, or assessing to which level that standard is being met
3. Labeling, or communicating the results of the assessment, including the assessment criteria with or on the product (Cassell & Symon, 2006)

Standard-setting is the first step of most certification and labeling schemes, ranging from seal-of-approval programs to ISO-type II eco-labels, to ISO-type III product-declaration labels (Dendler, 2012). Step 2, certification, is also an inherent part of most product-labeling schemes. Communicating the results of Step 2, on or with the product, distinguishes product-labeling from certification schemes (Dendler, 2012).

12.4 ASSESSING THE SUITABILITY OF DEVELOPING THE SUSTAINABILITY CHECKLIST FOR UNIDO

We assessed the suitability of developing the Sustainability Checklist further, through and for UNIDO's branding initiative participatorily by collecting feedback from two groups from Vietnam's handicraft sector—1) officials and representatives, and 2) value-chain actors—on using the checklist as certification criteria for a labeling initiative for the Vietnamese handicraft sector. The feedback was collected via questionnaire administered following our presentation to each group on the Sustainability Checklist and the evaluation method. Details of the exercise with the two groups and the findings thereon are as below.

GROUP 1: OFFICIALS AND REPRESENTATIVES FROM VIETNAM'S HANDICRAFT SECTOR

The first exercise to assess the suitability of developing the Sustainability Checklist further, through and for UNIDO's branding initiative, was conducted through at UNIDO's Branding Workshop in Hanoi, in March 2012. The workshop participants included 19 officials and representatives from across the Vietnamese handicraft-sector value chain. The workshop comprised several activities (Annexure 14)—including the icebreaking exercises used in Step 5 of the Rhizome Approach (10.5)—and our presentation on the Sustainability Checklist and the evaluation mechanism. Following the presentation, the participants discussed the viability of using the checklist as sustainability assessment criteria and evaluation mechanism for Vietnam's handicraft sector, and of developing a visual representation of the assessment through a branding and labeling scheme. We documented their inputs through notes on the discussions; in addition, a short questionnaire (Annexure 15) was administered to the participants to gather their focused feedback. The findings of this questionnaire are presented in Fig. 12.5–12.9, alongside the comparative findings from the second group which comprised value-chain actors from Vietnam's handicraft sector, discussed below.

GROUP 2: VALUE-CHAIN ACTORS FROM THE HANDICRAFT SECTOR

We administered a questionnaire (Annexure 16) to a cross section of 25 independently located company value-chain actors of the Vietnamese craft sector—including craftspeople, buyers, wholesalers, MSME owners and institutional representatives. The first part of the questionnaire was identical to the questionnaire administered to Group 1, and the second part had additional questions. These additional questions aimed to gather information from the value-chain actors on their perception vis-à-vis the value of branding the Vietnamese handicraft sector and the practical operational issues thereon. The questionnaire was administered in September 2012 under the framework of the UNIDO project by the UNIDO national expert, Kieu Pham Huyen, and his team. This was done in order to increase objectivity in the research, and also due to the language barrier.

COMPARITIVE FINDINGS

Usefulness of the checklist in understanding sustainability concerns

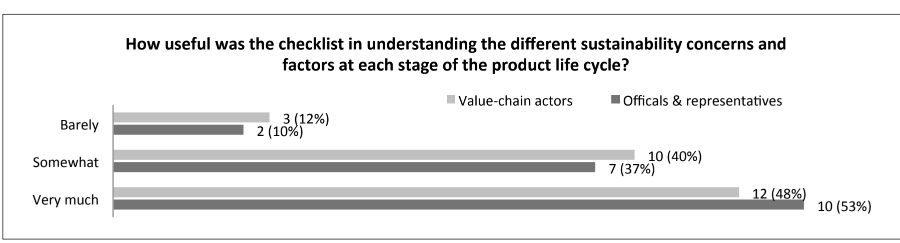

Figure 12.5: Comparison between findings from 19 respondents from Group 1 and 25 respondents from Group 2 on the usefulness of the checklist in understanding sustainability concerns

New sustainability-related factors learned through the checklist

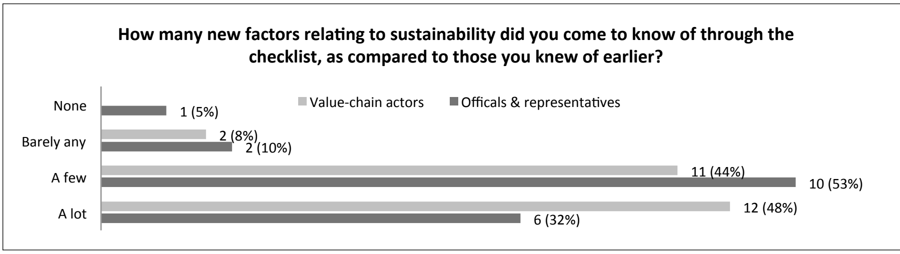

Figure 12.6: Comparison between findings from 19 respondents from Group 1 and 25 respondents from Group 2 on the usefulness of the checklist in creating awareness on different sustainability factors

Improving the checklist

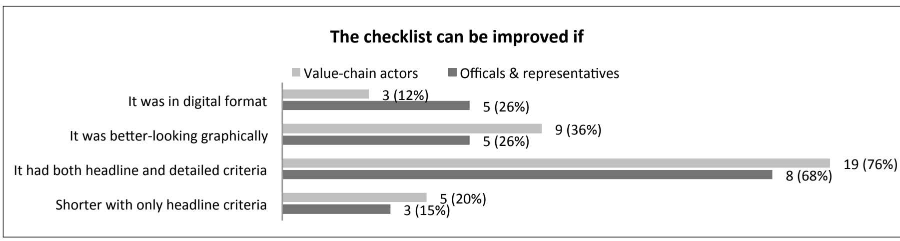

Figure 12.7: Comparison between findings 19 respondents from Group 1 and 25 respondents from Group 2 on improving the checklist

360-degree evaluation (discussed in 10.6)

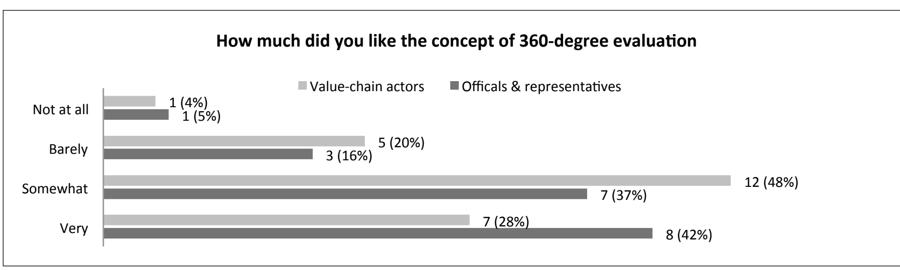

Figure 12.8: Comparison between findings 19 respondents from Group 1 and 25 respondents from Group 2 on the 360-degree evaluation

Sustainability landscape

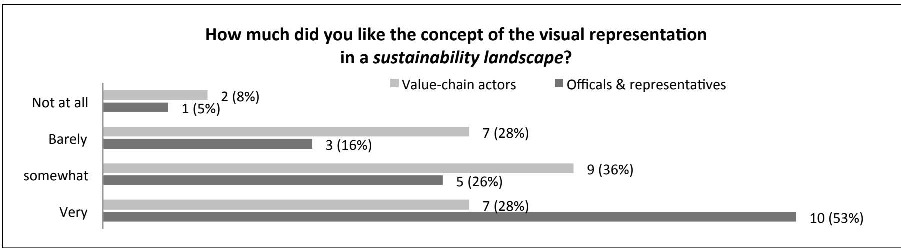

Figure 12.9: Comparison between findings 19 respondents from Group 1 and 25 respondents from Group 2 on visual representation in a sustainability landscape

Least-liked

We asked the respondents, "In your own words, please tell us which part of the entire system you liked worst and least and why." We clustered their comments, thematically as well as the additional comments respondents wrote against different questions. These comments are as below:

Criteria are difficult to understand

"So difficult to understand"

"Difficult to understand because of many specialized words "

"In my opinion, I would like to criteria of this more clear and simple to understand because almost the Vietnamese enterprises has low education (sic)"

"I like the checklist concept that helps things to be clearer"

"Quite complicated criteria system, some criteria are unclear in terms of measurement/ assessment"

"Definition of criteria should be provided, bullet points should be reconsidered"

"Criteria can be more simple"

Adapt to local conditions

"Needs to be adapted to local context"

"End-of-life handling considerations are not practical for Vietnamese procedures"

"Some questions are not realistic"

"Needs to be further studied to be suitable for Vietnamese context"

"Localized and adaptable to local condition and handicraft features"

The evaluation system can be easily manipulated
"The evaluation system proposed is too simple, easy to be distorted (sic) by corrupt evaluators, depending on persons rather than a concrete and transparent system"

Some criteria are more important than others/weightage
"Distribution consideration because it is somewhat not very relevant (sic)"

"Material and production: these criteria should be more detailed and measureable"

"The entire system is ok, customer consideration: should be more detailed"

"Weight factors should be applied"

"The checklist of criteria should be more simple and easier to use. There should be a system of weighting the relevant importance of each criteria concerning each sector studied. (Not all criteria are equally important to each sector) (sic)."

"I think that it should involve different proportions between the different criteria"

Organize criteria into larger groups
"Group certain criteria, e.g., under production once could have several subheadings (working condition/emp/CP, etc. could be grouped, packaging could be grouped also)"

Explain current rating and provide directions on improving rating
"Furthermore, add a column in which you provide a short description. E.g., Packaging can be more sustaining (sic) if it uses recycled material, less material, biodegradable, etc. Add a column in which you explain the rating given"

Learn from and dovetail with existing labeling systems
"There are some green label systems such as eco cotton. We should learn from these case study (sic)."

"VIRI HRPC is a member of WFTO (fair trade). We have 10 criteria to follow and it is already a lot of assessment and compromise!"

Clearer representation of the results
"I like the concept but the proposition with the dots is a bit confusing (colors of dots and numbers of dots)"

FINDINGS FROM PART 2 OF THE QUESTIONNAIRE

The questionnaire administered to the second group had an additional set of questions, on branding and operationalizing of the label. The questions explored what value-chain actors from the Vietnamese handicraft sector felt about sustainability, about a national brand for handicrafts underpinned by sustainability, about practical issues such as who should own the brand and how the assessment should be carried out, and also their thoughts on aligning this brand to Vietnam's national brand. The questions presented below are translations from the Vietnamese originals. The findings from these questions are as below:

Importance of sustainability

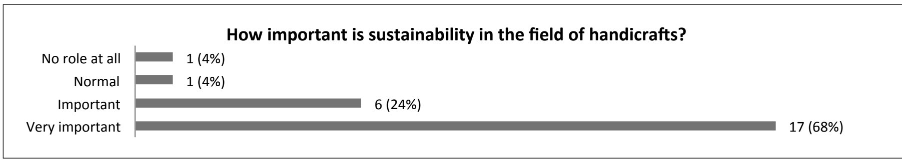

Figure 12.10: Findings from 25 Vietnamese value-chain actors on the importance of sustainability

Importance of sustainability brand value

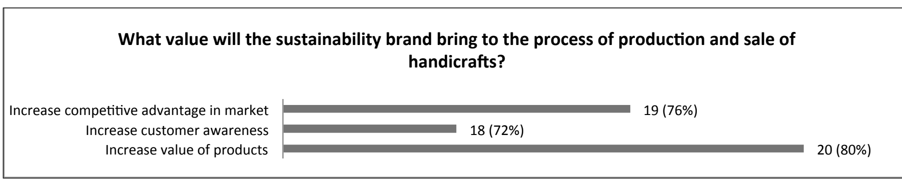

Figure 12.11: Findings from 25 Vietnamese value-chain actors on the importance of sustainability brand value

Most important stage of the life cycle for a sustainability brand

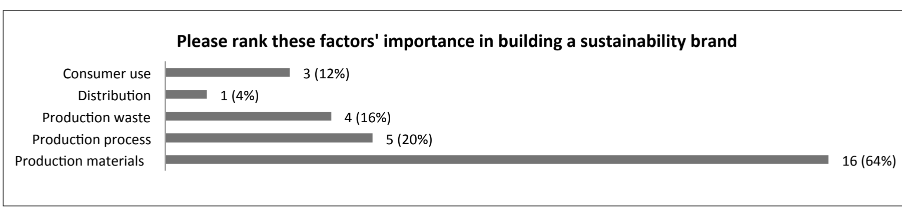

Figure 12.12: Findings from 25 Vietnamese value-chain actors on the most important stage of the life cycle for a sustainability brand

Who should be assessed?

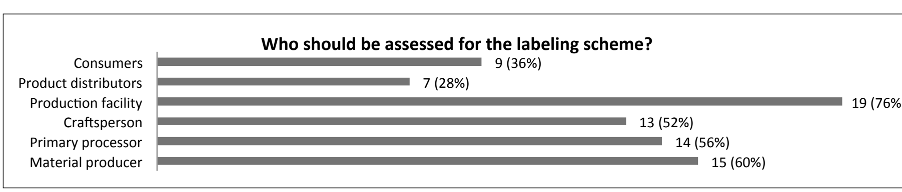

Figure 12.13: Findings from 25 Vietnamese value-chain actors on who should be assessed for the labeling scheme

Brand-building

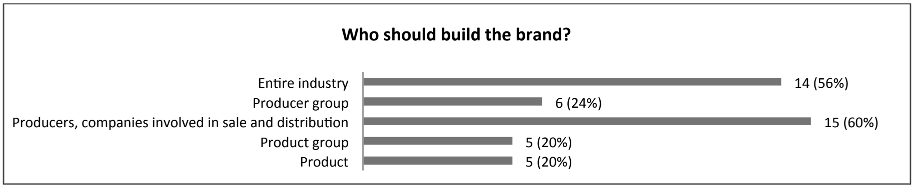

Figure 12.14: Findings from 25 Vietnamese value-chain actors on who should build the brand

Brand ownership

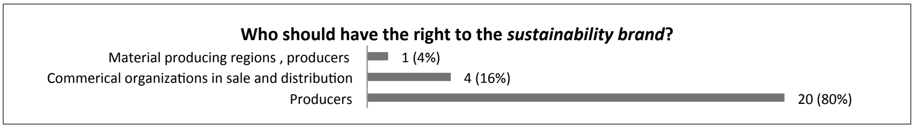

Figure 12.15: Findings from 25 Vietnamese value-chain actors on who should own the brand

Sustainability brand linked to national brand

Figure 12.16: Findings from 25 Vietnamese companies on whether the sustainability brand should be part of the national brand

12.5 REVISING THE CHECKLIST BASED ON FEEDBACK AND GETTING FEEDBACK FROM ANOTHER GROUP

Based on the feedback from the two groups, we revised the criteria of the checklist as in Fig. 12.17 below:

PCS	SUSTAINABILITY CHECKLIST	SUSTAINABILITY CHECKLIST VERSION 2
MATERIAL CONSIDERATIONS	Renewable	Uses renewable materials
	Minimally treated	Minimally treated
	Recyclable	Uses recyable materials
	Recycled	Uses recycled materials
	Local materials	Uses local materials
	Fair traded	Uses faily traded materials
		Uses certified materials (+)
		Uses non-toxic materials (+)
		Avoids materials from intensive agriculture (+)
PRODUCTION CONSIDERATIONS	Minimum material	Uses minimum material
	Minimum production steps	Has minimum production steps possible
	Renewable energy	Renewable energy used for production
		Minimal energy used for production (+)
	Less emissions	Uses low-emission techniques
		Production effluents and waste is properly managed (+)
	Less waste generated	Reduce production waste
	Waste reused	Resues production waste
		Reduce rejects (+)
	Indigenous treatments and processes	Uses indigenous treatments and processes
	Indigenous representation in decision making	Consults indigenous communities on production issues that affects them
	Healthy and safe work environment	Safe and healthy work environment
	Fair wages and benefits to producers	Fair wages and benefits to producers
	No child labour	No child labour
	No forced labour	No forced labour
		Fair working hours (+)
	Capacity-building of producers (–)	
		Allows freedom of association and collective bargaining (+)
	No discrimination	No discrimination
		Gender neutral (+)
	Respect for human rights	
		Provides local employment opportunities (+)

PCS	SUSTAINABILITY CHECKLIST	SUSTAINABILITY CHECKLIST VERSION 2
DISTRIBUTION CONSIDERATIONS	Minimum distribution volume	Minimum product volume
	Minimum distribution weight	Minimum distribution weight
	Energy-efficient transport	Uses minimum and clean transport
	Localised production to consumption system	Most of the PCS is local
	Minimum packaging	Minimum packaging
	Reusable packaging	Reusable packaging
	Recyclable packaging	Recyclable packaging
	Packaging made from reused/ recycled material	Packaging made from low-impact materials
CONSUMER-USE CONSIDERATIONS	Low/ clean energy consumption during usage	Uses minimum and clean energy
	Reduced and clean consumables during use	Uses minimum consumables
	Safe for users health	Safe to use
	Customizable	Customizable
	User friendly (–)	
	Affordable (–)	
	Easily upgradeable	Easily upgradeable
	Classic design	Classic design
	Promote a strong-user product relationship	Promotes user-product relationship
	Locally repairable and maintainable	Minimum and local maintenance and repair
END-OF-LIFE HANDLING CONSIDERATIONS	Mono-material	Mono-material
		Biodegradable (+)
	Designed for disassembly	Easy to disassemble
		Reusable (+)
	Recyclable packaging	Recyclable packaging
	End-of-life dissasembly facilitates employment for local communities	End-of-life phase facilitates local employment

Figure 12.17: Revised checklist criteria (Reubens 2013)

We presented the new checklist to a group of 14 different actors from the Vietnamese handicraft-sector value chain, at a UNIDO workshop in Hanoi on November 21, 2012, and solicited their feedback through a questionnaire (Annexure 17) and through focus-group discussions. The aim of this workshop was to discuss the refined checklist, and how it would work vis-à-vis the assessment. We noted the key points from the discussion. They are as below:

MINIMAL COMPLIANCE CRITERIA

The respondents agreed with our suggestion that there should be some minimal compliance criteria which were non-negotiable. The respondents suggested these criteria to be:
• Minimally treated
• No child and forced labor
• Safe for user's health

In addition, the respondents suggested that in order to qualify for the label, there should be a minimum score required in each of the four tenets—ecological, social, economic and cultural.

REMOVE CRITERIA

The respondents suggesting removing some of the criteria as below:
• Indigenous representation in decision-making
• Localized production and distribution systems to reduce physical production and delivery gap
• End-of-life handling facilitates employment for local communities through recycling

CLUB CRITERIA

The respondents suggested clubbing some of the criteria as below:
• Recyclable and recycled, as both have to do with recycling
• Reusable packaging and recyclable packaging
• Customizable and user-friendly
• All the criteria on packaging
• All the consumer criteria

EVALUATION

The respondents had suggestions on the evaluation as below:
• There should be evaluators from consumer-protection agencies
• While a self-evaluation from the company is an important exercise, it should not be included in the scoring
• There should be knowledgeable, independent evaluators
• Sector associations can be involved in evaluation

WEIGHTAGE

The respondents agreed collectively on the need for weightage for the different criteria for use in different value chains and sectors

12.6 DESIGN OF THE FINAL ITERATION: STANDARD-SETTING

Based on the feedback from the three groups, and meetings with different stakeholders in the handicraft value chain, we finalized the design of the final iteration called the UNIDO Holistic Sustainability System—including its components, namely, standard-setting, certification and labeling. We discuss the first component in this section, and the remaining two in the following sections.

STANDARD-SETTING: THE HOLISTIC SUSTAINABILITY CHECKLIST

The Sustainability Checklist—developed during the first phase of design and development of our research—was refined into the Holistic Sustainability Checklist during the second phase of design and development. The checklist was graphically improved (Fig. 12.19) and icons developed to indicate the key dimensions, in response to the findings which indicated that participants would be more likely to use it if it looked better graphically.

The Holistic Sustainability Checklist (Fig. 12.19) draws on different frameworks such as the D4S rules of thumb by UNEP and Delft University of Technology, the Business for Social Compliance (BSCI) code of conduct of the Foreign Trade Association (FTA) and the conventions of the International Labour Organization (ILO). The Holistic Sustainability Checklist therefore functions as a theoretically integrative framework that supports the policies, standards and compliance methodologies of different institutions working towards sustainability at different nodes of the production-to-consumption system.

The Holistic Sustainability Checklist illustrates the generic production-to-consumption system (Fig. 12.18) for product-material selection, production, distribution, use and end-of-life handling, and the design for sustainability (D4S) parameters relevant at each stage.

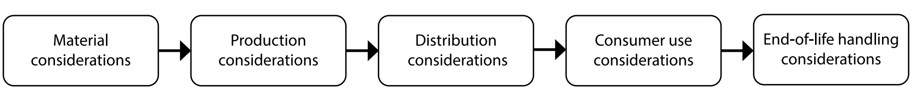

Figure 12.18: Generic production-to-consumption system (Reubens 2013)

The social, cultural, ecological and economic tenets of sustainability strongly influenced by each parameter are indicated. This creates awareness on the potential and desired criteria that can make a product more holistically sustainable at each node of the production-to-consumption system. The checklist can be used as a guideline, during the product-development or innovation stage, or as a standard, during product redesign. Newly developed and existing products can be evaluated against the same checklist in Stage 2, making it an indicator of sustainability factors achieved.

HOLISTIC SUSTAINABILITY CHECKLIST		ECOLOGICAL	SOCIAL	CULTURAL	ECONOMIC
MATERIAL CONSIDERATIONS	1 Renewable materials	•			
	2 Minimally treated materials	•			•
	3 Recyclable materials	•			•
	4 Recycled materials	•			
	5 Local materials	•	•	•	•
	6 Fairly traded materials		•		
	7 Ecologically certified materials	•			
	8 Non-toxic materials	•	•		
	9 Less/no materials from intensive agriculture	•			
PRODUCTION CONSIDERATIONS	10 Minimum materials	•			•
	11 Minimum production steps	•			•
	12 Renewable energy for production	•			
	13 Minimal energy for production	•			•
	14 Low-emission-techniques	•	•		
	15 Proper management of production effluents and waste	•	•		
	16 Reduce/reuse production waste	•			•
	17 Indigenous treatments and processes	•	•	•	•
	18 Consulting indigenous communities on production issues that affect them		•	•	
	19 Safe and healthy work environment		•		•
	20 Fair wages and benefits to producers		•		•
	21 No child labour		•		•
	22 No forced labour		•		
	23 Fair working hours		•		
	24 Freedom of association and collective bargaining		•		
	25 No discrimination		•	•	
	26 Local employment opportunities		•	•	•
DISTRIBUTION CONSIDERATIONS	27 Minimum product volume and weight	•			•
	28 Minimum and clean transport	•			•
	29 Local PCS	•	•		•
	30 Minimum packaging	•			•
	31 Reusable packaging	•		•	
	32 Recyclable packaging	•			•
	33 Packaging made from low-impact materials	•			
CONSUMER USE CONSIDERATIONS	34 Minimum/clean energy during usage	•		•	•
	35 Minimum consumables	•			•
	36 Safe to use		•		
	37 Customizable	•		•	•
	38 Easily upgradable	•		•	
	39 Classic design	•		•	
	40 Minimum and local maintenance and repair	•	•	•	•
END-OF-LIFE HANDLING CONSIDERATIONS	41 Reduced material complexity	•			
	42 Biodegradable	•			
	43 Easy to disassemble	•			•
	44 Reusable	•		•	
	45 Recyclable	•			•
	46 Promotes/uses local recycling systems	•	•	•	•

Figure 12.19: Holistic Sustainability Checklist

The final criteria for the Holistic Sustainability Checklist were shortlisted based on inputs from a UNIDO focus group, comprising diverse participants from across the Vietnamese handicraft value chain, in Hanoi on November 21, 2012. Each criterion is discussed in detail in UNIDO's manual, *Achieving, Assessing and Communicating Sustainability: A Manual for the Vietnamese Handicraft Sector,* which is an output of the documentation-and-dissemination phase of our design science research—and on which this chapter draws.

12.7 DESIGN OF THE FINAL ITERATION: CERTIFICATION

Based on the feedback from the three groups, and meetings with different stakeholders in the handicraft value chain, we finalized the design of the final iteration of the certification process, called the Holistic Sustainability Assessment. In an ideal situation, each product should be separately assessed for sustainability. However, this may not be possible, especially in the initial start-up phase of labeling programs, when the requisite resources, support and infrastructure to implement the labeling scheme may not be in place. Therefore, the Holistic Sustainability Assessment system advocates that each country/sectoral institution decide for itself whether the assessment should be at the level of the product, company or sector, depending on existing logistical infrastructure.

EVALUATORS

Once the implementing agency decides the level at which to conduct the evaluation, a minimum of three evaluators will check the product/company/sector against the Holistic Sustainability Checklist. While the criteria for selecting an evaluator will vary in each context, it is suggested that they be chosen from reputed institutions to increase the legitimacy of the evaluation (Dendler, 2012). As far as possible, each evaluator should be a reputed institution, which can, in turn, delegate a member of its staff to conduct the evaluation. It is recommended that the evaluators reflect the groupings of institutional subordinates, peers and supervisors in order to facilitate a well-rounded evaluation. This is in line with the idea of 360-degree feedback, where feedback comes from sources other than the traditional manager or supervisor. Including feedback from different nodes of the value chain and production-to-consumption system—including self-evaluation—helps to incorporate crosscutting perspectives into the evaluation, and helps future performance. The goal of this approach is to improve future sustainability performance, alongside evaluating current performance.

EVALUATION METHOD

Each evaluator scores the product relative to the criteria outlined in each parameter. A score of 1 would indicate low or below average, 2 would indicate medium or average, and 3, high or demonstrably better. The final score per parameter will be the triangulated mean of the three grades. Scores from 0 to 1 will be considered low, from 1.1 to 2 will be considered medium, and from 2.1 to 3 will be considered high. This final score will be reflected in the ecological, social, cultural and economic sustainability that the parameter affects (Fig. 2.20).

PCS	UNIDO	ECOLOGICAL	SOCIAL	CULTURAL	ECONOMIC
MATERIAL CONSIDERATIONS	Uses renewable materials				
	Minimally treated				
	Uses recyable materials				
	Uses recycled materials				
	Uses local materials				
	Uses faily traded materials				
	Uses certified materials				
	Uses non-toxic materials				
	Avoids materials from intensive agriculture				
PRODUCTION CONSIDERATIONS	Uses minimum material				
	Has minimum production steps possible				
	Renewable energy used for production				
	Minimal energy used for production				
	Uses low-emission techniques				
	Production effluents and waste is properly managed				
	Reduce production waste				
	Resues production waste				
	Reduce rejects				
	Uses indigenous treatments and processes				
	Consults indigenous communities on production protocols that affect them				
	Safe and healthy work environment				
	Fair wages and benefits to producers				
	No child labor				
	No forced labor				
	Fair working hours				
	Allows freedom of association and collective bargaining				
	No discrimination				
	Provides local employment opportunities				

PCS	UNIDO	ECOLOGICAL	SOCIAL	CULTURAL	ECONOMIC
DISTRIBUTION CONSIDERATIONS	Minimum product volume				
	Minimum distribution weight				
	Uses minimum and clean transport				
	Most of the PCS is local				
	Minimum packaging				
	Reusable packaging				
	Recyclable packaging				
	Packaging made from low impact materials				
CONSUMER-USE CONSIDERATIONS	Uses minimum energy during usage				
	Uses clean energy during usage				
	Uses minimum consumables				
	Safe to use				
	Customizable				
	Easily upgradeable				
	Classic design				
	Promotes user-product relationship				
	Minimum and local maintenance and repair				
END-OF-LIFE HANDLING CONSIDERATIONS	Reduced material complexity				
	Biodegradable				
	Easy to disassemble				
	Reusable				
	Recyclable				
	Promotes/uses local recycling systems				

Figure 2.20: Depiction of the tenets that each parameter impacts

Take, for example, a scenario where a product is being evaluated against Parameter 1—renewable materials—by evaluators A, B and C. Supposing the scores given by the three evaluators are 2, 2 and 3, respectively, the overall score for this parameter would be 2+2+3 divided by 3; so 7/3 or 2.33. If the same product is being evaluated against Parameter 2—

minimally treated materials—and evaluators A, B and C rate it 2, 3 and 3, respectively, the overall score for this parameter will be 2+3+3 divided by 3, or 8/3, which is 2.67. The score for Parameter 1 will reflect in ecological sustainability, as this is the tenet it impacts. The score for Parameter 2, i.e., minimally treated materials, will reflect in both ecological and economic sustainability as it impacts both of these tenets.

SCORING

Such a scoring system takes into consideration the fact that meeting or not meeting criteria is often not a black or white absolute, and so works better than a basic minimum-requirement approach. The scoring system acknowledges that criteria can be met to varying degrees, and reflects both negative and positive aspects of meeting criteria. A negative score can motivate better performance, as low-score areas are communicated to both the consumer and the producer. Scoring also offers the possibility to strategically compensate for low scores in certain criteria with higher scores in other criteria (Scheer & Rubik, 2005). This reflects the reality of trade-offs between sustainability's social, cultural, economic and ecological aspects.

BENCHMARKS

This labeling scheme has been designed as a flexible framework, which can be adapted to several regions and countries. Labels such as that of Fair Trade and EU Eco-label have been criticized for their insufficient adaptability to local conditions, whereas labeling organizations such as the Marine Stewardship Council and EU energy have been criticized for inconsistent interpretation of criteria (Dendler, 2012). Being mindful of these critiques—and considering that the system may be used in several developing countries with vastly different contexts and resources to implement this labeling—the Holistic Sustainability Assessment first defines crosscutting and generic standards, and then goes on to describe the sustainable ideals and unsustainable practices clearly. It does so a manner that is flexible enough to allow for regional and geographical variability in the interpretation and definition of these standards (Dendler, 2012). The scoring is therefore relative to outlined criteria in each parameter, described earlier on in the Holistic Sustainability Checklist.

STRINGENCY

While assessment should ideally be as stringent as possible, the method of scoring takes into account variations in infrastructure and resources, and hence allows the country/sectoral institution flexibility in terms of stringency. The respective country/sectoral institution can identify the criteria it deems non-negotiable, based on statutory legislation and the international norms. Some parameters—such as user safety, no child labor or forced labor—and statutory compliance measures—such as proper disposal of effluents—may be scored more stringently than others due to their inherent non-negotiability. Some parameters may which already have existing high standards may also be rated more stringently—for example, using recycled materials for a sector that can more easily use, and which does already routinely use, recycled materials.

The level of stringency should be increasingly reviewed and increased annually, or at regular intervals, as the labeling scheme becomes more mature, and those being assessed become more familiar and comfortable with the assessment procedure. This is in line with the ISO-Type I labels, which review and tighten their standards regularly (Dendler, 2012).

MINIMUM COMPLIANCE CRITERIA

Different labeling schemes prioritize different criteria. However, compliance with some criteria—such as user safety, no child labor or forced labor—and statutory compliance measures—such as proper disposal of effluents—are non-negotiable. Each country/ sectoral institution will identify the criteria which are non-negotiable based on statutory legislation and international norms. These criteria will comprise the minimum compliance criteria, and those products/organizations failing to comply with these may not be part of the labeling scheme until they meet these criteria.

SOFTWARE

In line with the feedback from the respondents from the SPIN group in Vietnam and the Indian respondents who indicated that the checklist would be easier to use and implement if it was digital, we developed a Web-based software in conjunction with a technical expert in India, to make the Holistic Sustainability Assessment easy to implement. Its features support the creation of a database of companies, products, evaluators and evaluations. Thus, while evaluating a product or company, evaluators can be selected from the database based on their professional expertise or institutional profile.

The sustainability landscape of each sector is different and, therefore, the assessment mechanism needs to be mindful of this difference. This is why the software also allows customization of the master Holistic Sustainability Checklist by adding or deleting criteria. In addition, the weightage of each criterion can be customized. For example, *made from recycled materials* could be given very high importance in a checklist customized for the handmade paper or glass sector, but comparatively low for a sector which uses low processed natural materials such as sea grass. This is in line with the discussion on stringency and minimum-compliance criteria in the subheads above.

12.8 COMMUNICATION: THE HOLISTIC SUSTAINABILITY LABEL

Communicating the score in an easy-to-understand manner is central to the success of a labeling scheme. To ensure easy communication—especially when the audience ranges from household consumers to tourists to import companies—the best approach seems to be to condense the score into a single level of grading (Banerjee & Solomon, 2003; Truffer et al, 2001). While this approach makes communication simple and clear, highly condensed information reduces the decision-making capacity of an audience who might want more detailed information (Teisl & Roe, 2005). Various options for the graphic representation of the sustainability score were developed. The final version—the four-ring Holistic Sustainability Graphic (Fig. 12.21)—was shortlisted based on feedback from stakeholders across the value chain, and questionnaires randomly administered to 15 respondents at UNIDO's booth at the LifeStyle Vietnam fair in 2013 to check which graphic depiction they preferred. Considering that the right amount of information needs to be communicated simply, the Holistic Sustainability Label shows four sub-level grades—one each for the ecological, social, cultural and economic aspects. These scores are then communicated through a single Holistic Sustainability Graphic that encompasses the four sub-level scores. The four sub-level grades are aggregated into a single holistic sustainability grading, indicated by the stars.

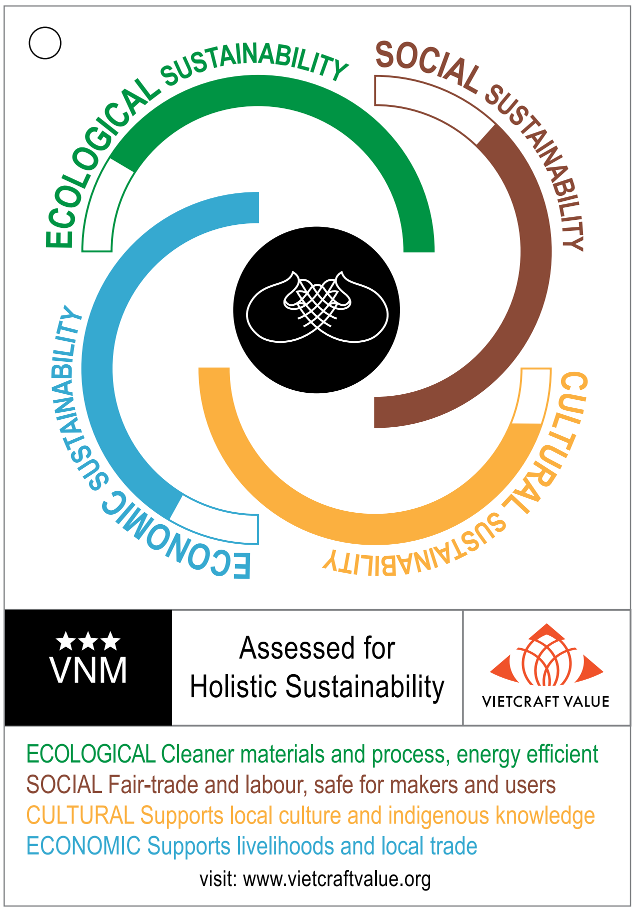

Figure 12.21: Holistic Sustainability Label (Reubens 2013)

The final Holistic Sustainability Label communicates the scoring through an easy-to-understand graphic, supported by a legend. The design elements that comprise the graphic were finalized based on feedback from a cross section of stakeholders. These elements are elaborated upon below.

FOUR-RING HOLISTIC SUSTAINABILITY GRAPHIC

The final graphic comprises four rings, each of which represents one of the tenets of sustainability. The rings are interlinked, to represent the complete and cohesive system formed by the ecological, social, cultural and economic tenets of society. The rings were chosen over linear elements to represent the holistic, 360-degree circular ethos of the assessment and labeling system.

Each ring functions as a meter to communicate the single-level grade of the social, ecological, economic and cultural tenet of sustainability. The rings are color-coded (House of Commons Environmental Audit Committee, 2009) to enable easy and intuitive understanding of the tenet they represent. The ring for ecological sustainability is green, the one for economic sustainability is blue, the ring for social sustainability is brown, and the one for cultural sustainability is yellow. In addition to color, the tenet each ring represents is clearly communicated by text—*ecological sustainability/social sustainability/cultural sustainability/economic sustainability*—placed around the ring.

SECTOR ICON

At the center of the four rings is a circle containing an icon, representing the sector domain of the Holistic Sustainability Label. Since the labeling scheme is for the handicraft sector, the icon has two hands intertwined to represent the handicraft sector. The Holistic Sustainability Label was designed to be extendable to sectors other than handicrafts. In each case, relevant icons for that sector will replace the handicraft-sector icon.

COUNTRY CODE

Since this labeling scheme is designed to be extended to different geographies and regions, a country code—consisting of the key letters in the country name—was included above the star rating. This was also necessary because as discussed earlier, the level of stringency of assessment may differ from country to country, so the country in which the labeling scheme is being implemented needs to be clearly communicated on the label. The three-letter country codes used in the label allow for easy visual communication of names of countries. It is recommended that the country codes used are as defined in ISO 3166–1 standardized by the International Organization for Standardization 3166 Maintenance Agency (ISO 3166/MA) (ISO, n.d.).

LEGEND

A legend included at the bottom of the graphic uses key words to clearly communicate the key areas covered by the four rings. These key words were arrived at by choosing phrases that are popularly used in sustainability frameworks, including in educational and marketing frameworks. Using key words that are easily understandable and that have an association with other common frameworks, increases the legitimacy of each sub-grade.

12.9 SUMMARY AND CONCLUSIONS

This chapter discussed how we refined the Sustainability Checklist and evaluation of the Rhizome Approach in order to answer Research Question 3 (What sort of mechanisms would support and encourage the use and operationalization of the Rhizome Approach and its constituents?). As in the case of our development of the Rhizome Approach, we developed this mechanism through an iterative design science research process, where we defined a real-world context, which would represent the larger problem class of our domain—craft-based MSMEs in developing countries working with renewable materials, and who were linked to designers.

We began the process through a literature review which pointed out that MSMEs are generally less able to absorb the cost of legislation as compared to larger businesses (Angus, Booth, Armstrong, & Pollard, 2013). While hard regulation and economic instruments can force or incentivize behavior, respectively, in the long run the driver for the company to stay on the sustainability track needs to come from an internal, and not external, motivation (Pape et al, 2011). Recent studies reveal that internal drivers such as the possibility to increase competitive edge (Bey, Hauschild, & McAloone, 2013) by tapping innovation opportunities and through better product-quality and customer demands are stronger drivers than regulation (van Hemel & Cramer, 2002). In addition, a study from the UK suggests that the impact of regulations on end-of-pipe technologies and environmental research and development is much clearer than in the case of integrated, cleaner production technologies (Demirel & Kesidou, 2011)—such as non-industrial craft-based technologies used to process renewable materials in developing countries. Most policies still focus on policing end-of-pipe technologies, rather than integrated, cleaner technologies (Angus et al, 2013)—they focus on cleaning up, rather than systemic innovation. Therefore, we concluded that soft regulation and labeling comprised the broad answer to Research Question 3. Our literature review tried to identify preexisting sustainability labeling schemes and labeling schemes in the handicraft sector which could provide an answer to Research Question 3. However, the schemes we reviewed did not address the dimensions of sustainability holistically. Therefore, we decided to develop such a mechanism through empirical research.

We selected UNIDO's branding initiative in Vietnam as the platform for this empirical research. The initiative was looking for a way to keep the MSMEs it had supported vis-à-vis inputs on sustainability, on the track to sustainability, by adding value to, and creating differentiation for, their products through branding. The suitability of using the Sustainability Checklist for this initiative was ascertained in a participatory manner, using some of the exercises we had designed to facilitate the Rhizome Approach to encourage participation from the stakeholders. We collected the feedback from these participants by questionnaire, using a workshop as the vehicle. In addition, we collected feedback from a second group comprising of the different nodes of the value chain on the same issue. Using this feedback, we refined the checklist and evaluation and ran the second iteration by a group of stakeholders from the Vietnamese handicraft sector and collected qualitative data from the same.

Finally, we offered the final version of our design, known as the Holistic Sustainability System, which would work as the mechanism to support and encourage the use and operationalization of the Rhizome Approach and its constituents in answer to Research Question 3. Various options were designed for the graphic representation of the Holistic Sustainability Label and the Holistic Sustainability Checklist. These were evaluated through discussions with stakeholders in Vietnam, and also by administering random questionnaires at UNIDO's booth at the LifeStyle Vietnam fair. A detailed account these can be found in UNIDO's manual, *Achieving, Assessing and Communicating Sustainability: A Manual for the Vietnamese Handicraft Sector*—which is an output of the documentation-and-dissemination phase of our design science research—and on which this chapter draws.

The Holistic Sustainability System we developed for UNIDO's branding and labeling initiative leveraged the additional time and cost investment in a holistic sustainability-aligned design process as value-addition and product-differentiation. The outputs of the Holistic Sustainability Checklist were quantified and communicated, thus legitimizing sustainability efforts as credentials. Both of these showed how the investment in sustainability is worthwhile for companies, thus creating a pull for designers to practice sustainability holistically by using the Rhizome Approach, thereby answering Research Question 3.

UNIDO's beneficiary, VIETCRAFT, was accepted to operationalize the Holistic Sustainability System by the Vietnamese Ministry of Industry and Commerce in August 2015 and the website which showcases the system is now online (Vietcraft Excellence, 2015). This indicates that our mechanism, i.e., the Holistic Sustainability System and the branding and labeling scheme were well-received by the Vietnamese handicraft sector, which is representative of the larger client class—handicraft sector MSMEs in developing countries. Additional validation for the efficacy of the Holistic Sustainability System are that two other institutions working with handicraft MSMEs in Vietnam—the Sustainable Product Innovation (SPIN) project and the Centrum tot Bevordering van de Import uit Ontwikkelingslanden (CBI)—also showed interest in it. Of this, SPIN used the Holistic Sustainability Assessment, including the Holistic Sustainability Checklist, for its assessments, and plans to also use it for the assessment of the larger SPIN project (Jin, 2015). In addition, Shauna Jin, a PhD researcher at Delft University of Technology linked to the SPIN project, adapted and used the Holistic Sustainability Assessment to evaluate the outcome of her collaborative-design project for Vietnamese MSMEs. This interest, and the usage it has already translated into, confirms that Holistic Sustainability System and its mechanisms are potentially applicable to the larger client class—handicraft-sector MSMEs in developing countries. Further learning and conclusions on the Holistic Sustainability System, and the overall research in general, are discussed in the following, final chapter of this research.

13 CONCLUSIONS AND RECOMMENDATIONS

This chapter offers the conclusions and recommendations of our thesis, towards reflectively and coherently tying together pertinent issues covered in the preceding chapters and the findings and learning thereon.

The main findings of this research are consolidated and presented in 13.1. The theoretical contributions are offered in 13.2. We offer our findings juxtaposed against our conceptual framework in 13.3. The limitations and gaps of this research, which present avenues for future research, are explored in 13.4. Finally, our closing thoughts are presented in 13.5.

13.1 MAIN RESEARCH FINDINGS

We started this thesis with the assumption that design for and in developing countries can be instrumental in realizing development that is holistically sustainable—which looks not only at ecological and economic aspects, but also social and cultural aspects. This is especially so in the case of design for and with MSMEs in developing countries which work with renewable materials such as bamboo, cork and hemp. These materials are abundantly available in the developing world, and have the potential to be a viable and sustainable resource base; the processing of which can employ the developing world's huge labor force. The resultant products can tap into the growing markets for sustainability-aligned products around the world, which are increasingly looking beyond ecological considerations, to include a wider spectrum of sustainability criteria (Potts et al, 2010). The spin-offs from the production of these products in the developing world—including employment generation and the resultant income security, poverty-reduction, food-security, access to healthcare and education—can simultaneously contribute to sustainable development in the developing world.

There has been a steady emergence of *green* products, which address the ecological dimension of sustainability, in response to the global market demand for sustainable products and systems (Potts et al, 2010). The material sourcing and production of these products are often done in the developing world where renewable materials are abundant and the cost of production is low. Often, the designers of these aforementioned *green* products recontextualize renewable material through industrial techniques and technologies, resulting in ecologically sustainable products with commercial viability. However, a narrow ecological and economic design focus (Reubens, 2013) keeps these products from being the basis for production-to-consumption systems that address a compound picture of sustainability. This picture would include the social and cultural dimensions—both of which are very important for developing countries, reeling under the issues of poverty, unemployment and increasing consumption.

Most renewable materials are already part of languishing craft production-to-consumption systems whose decline causes unsustainability at several levels. The lack of economic or productive skills, assets and options (Society for Rural, Urban and Tribal Initiatives, 1995), has led to the distress migration of craftspeople to urban areas in search of wage labor (Society for Rural, Urban and Tribal Initiatives, 1995). This distress migration, together with unprecedented urbanization (Akubue, 2000; Craft Revival Trust, 2006) causes: a) tremendous socio-economic unsustainability, and b) the loss of cultural capital due to vanishing crafts. If designers were to build upon traditional production-to-consumption systems—by leveraging their craftspeople, technologies, and knowledge as inputs for their designs and the production-to-consumption systems that result from these designs—they could create products that address sustainability in a holistic manner. They would be made from renewable materials (ecologically sustainable), crafted in a labor-intensive manner (socially sustainable), build on craft traditions and indigenous knowledge (culturally sustainable) and target viable sustainability-aligned markets (economically sustainable).

In order to address the many layers of sustainability in the context of developing countries, design needs to facilitate production-to-consumption systems that are underpinned by technologies which have a high potential for employment, are not capital-intensive, and are highly adaptable to social and cultural environments (Jequier & Blanc, 1983). To do this, design needs to challenge mainstream, technology-intensive, industrial design approaches, which do not address the concept of sustainability in a holistic manner (Maxwell et al, 2003). This is easier said than done, as the design–industrialization bond is deeply rooted; the discipline of design emerged as a result of the process of industrialization and, therefore, inherently aligns to industrial logic and philosophies.

Our research, therefore, focused on the relatively unexplored area of alternatives to mainstream design approaches (Maxwell et al, 2003) by asking Research Question 2— What could be a possible sustainability-design approach that is: a) mindful of the pros and cons of the existing sustainability design approaches, and b) which looks at addressing a holistic picture of sustainability—including its ecological, social, economic and cultural dimensions—in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries? In order to avoid presupposing that existing design approaches do not address sustainability holistically in the context we defined, we explored the extent to which design addresses sustainability in a holistic manner (Research Question 1). Finally, in order to support the operationalization of such an approach, we asked Research Question 3: What mechanisms would support and encourage the use and operationalization of any sustainability-design approach that might be developed in response to Research Question 2?

Our main research findings were as follows:

THERE IS NO SINGLE UNDERSTANDING OF SUSTAINABILITY

The concept of *holistic sustainability* is a key underpinning of our research. Based on our literature review, we argue that *holistic* is a pleonasm for sustainability; sustainability is inherently a holistic construct which includes the sum of all of its conceptual subsets including ecological sustainability, social sustainability, cultural sustainability and economic sustainability. *Sustainability* has no single commonly accepted definition; there have been several interpretations of this concept given that human understanding of sustainability and its dimensions is expanding (Mann, 2011). Over time, the social (people), ecological (planet) and economic (profit) dimensions of sustainability have been supplemented by culture as a vital tenet (Duxbury & Gillette, 2007).

In order to anchor our inquiry, we drew on our literature review (Chapter 3), to define sustainability as:

A continual process of actualizing "the possibility that humans and other life will flourish on the Earth forever" (Ehrenfeld, 2008) by maintaining the balance between different dimensions, including ecological, cultural, social and economic ones.

Our broad-based, inclusive and holistic definition of sustainability is underpinned by the Four Pillars model of sustainability, because its ecological, social, cultural and economic pillars encompass the broad themes contained in current and emerging discussions on holistic sustainability. The four pillars are also congruent with the set of 17 UN Sustainable Development Goals which outline the need for sustainable development to be holistic and balanced (Le Blanc et al, 2012).

SUSTAINABILITY RESTS ON SUSTAINABLE DEVELOPMENT

In order to understand where, when and how the sustainability problem began, we attempted to trace the beginning of unsustainability through our literature review (Chapter 3). We found that while the beginning of unsustainability is commonly traced back to the industrial revolution, the conditions for the industrial revolution's full-blown *take-off* (Rostow, 1960) were created over the course of human development, and by the production-to-consumption systems that underpinned this process. The current state of unsustainability cannot therefore be attributed to the industrial revolution, or any isolated phenomenon (Rostow, 1960). It is the cumulative result of the development process. Development resulted in secure production-to-consumption systems, which resulted in population growth, which called for more resources and which, in turn, prompted more development (Nkechinyere, 2010). Thus, through the ages, development has been both the cause and effect of incremental development, and simultaneous incremental unsustainability.

Each production-to-consumption system that emerged and evolved over the development process had significant direct and indirect impact on the world and its systems. The tiniest change in each production-to-consumption system affected each of the world's complex, interlinked and dynamic systems to differing degrees. Sustainability—or the lack thereof, i.e., unsustainability—is, therefore, the emergent property of the collective production-to-consumption systems that underpin development (Nkechinyere, 2010). This interconnectedness points to the fact that efforts to cultivate and maintain sustainable development must rest on a holistic concept of sustainability, which is mindful of multiple dimensions. This sentiment has been reiterated through different global forums and platforms, including the recent UN Sustainable Development Goals that outline the need for sustainable development to address all of sustainability's dimensions and their interlinkages in a balanced manner (Le Blanc et al, 2012).

DESIGN HAS THE POTENTIAL TO SHAPE DEVELOPMENT BY SHAPING THE PRODUCTION-TO-CONSUMPTION SYSTEMS ON WHICH IT RESTS

Design—"the act of deliberately moving from an existing situation to a preferred one by professional designers or others applying design knowingly or unknowingly (Fuad-Luke, 2009)"—shapes production-to-consumption systems and, thereby, sustainability (4.2). Design decisions orchestrate production-to-consumption systems, including material production and processing, fabrication, distribution, use, repair and maintenance, and end-of-life handling (Waage, 2005)—and thereby determine the flow of materials and human resources (White et al, 2008). These production-to-consumption systems in part and in whole, and their collateral effects—including environmental, social (White et al, 2008) and cultural spin-offs—shape sustainability. The possibility of shaping production-to-consumption systems towards sustainability challenges designers to create a counter-narrative (Fuad-Luke, 2009) that seeks to pro-actively actualize holistic sustainability and step out from their traditionally values-agnostic orientation (White et al, 2008) into the role of an activist (Thorpe, 2007). This possibility is more realizable than ever before, since the increasing scope, role, and power of designers positions them as key players in strategic decisions, which determine production-to-consumption systems, and thereby sustainability, around the world (British Design Council, 2004; Swedish Design Industry, 2004).

DESIGN DOES NOT CURRENTLY ADDRESS SUSTAINABILITY IN A HOLISTIC MANNER

In order to understand the extent to which design addresses sustainability holistically, we looked at two aspects—design practice (4.5) and the existing approaches and assessment methods which position themselves as sustainability-aligned (4.4), and whose frameworks and tools provide scaffolding for designers working towards sustainability.

Our investigation into sustainability practice revealed that the interest in sustainability and sustainable design (Fuad-Luke, 2009) has not translated into frequent practice by designers in either developed (Aye, 2003; Kang et al, 2008; Kang & Guerin, 2009; Mate, 2006) or developing countries (Hankinson & Breytenbach, 2012). The approaches and assessment systems we studied prioritized the economic and ecological aspects of sustainability—with the exception of BoP and SLCS, which prioritized the social dimension. Not one looked at sustainability in a holistic manner. However, the fact that the newer and hybridized frameworks and assessment systems, including D4S, LCSA and EVR, increasingly recognize and attempt to address multiple factors, despite retaining their economic and ecological precedence, confirms the need and gap for a holistic sustainability approach and assessment system.

CRAFT–DESIGN COLLABORATIONS CAN ADDRESS SUSTAINABILITY BUT CURRENTLY DO NOT

We studied the decline of flourishing craft production-to-consumption systems in the developing world, first due to the industrial revolution—which created low-cost, high-volume industrialized goods—and the subsequent information revolution which facilitated their penetration into previously inaccessible markets and, more importantly, into the psyche of consumers (5.1). Over the past few decades, craftspeople in developing countries have found themselves disconnected from their consumers, unable to cater to distant markets and, therefore, with no takers for their products (Jaitley, 2001). Several crafts have vanished or are declining (Jaitley, 2001), and the low-cost craft available comes with hidden costs—including environmental degradation, unsafe and unhealthy working conditions, and unfair wages (Chotiratanapinun, 2013).

We also outlined the opportunity that the information revolution offers to craftspeople to dovetail with its growing *knowledge class* (Humbert, 2007). The information revolution replaces capital and labor—the key factors of production of the industrial revolution—with knowledge and information (Humbert, 2007). This creates a new development paradigm that links the economy and culture; and acknowledges that creativity, knowledge and access to information are powerful engines for economic growth and development in a globalizing world (United Nations Conference on Trade and Development, 2008). If craft's indigenous knowledge is not recognized or leveraged, the perilous situation of craftspeople will grow even more untenable, due to their lack of formal education and formalized knowledge (Bhaduri, 2016).

Our literature review (5.2) revealed that craft offers a potential platform to address sustainability, especially in our context of developing-country MSMEs working with renewable materials, because many overarching concepts of sustainability—for instance, environmental responsibility, social justice, cultural diversity and economic inclusion (Borges, 2013)—underpin craft practice (Rees, 1997). Craft has a huge potential to contribute to sustainable development in developing countries. It is labor-intensive; it comprises a substantial part of the economic fabric of developing countries; and it has the potential to dovetail with the information revolution's knowledge and creative economy, to access new and lucrative sustainability-aligned markets. For these reasons, it provides developing countries with the opportunity to side-step the generic development paradigm, provided it can dovetail with the innovation-led, value-added and manufacturing-oriented paradigm, through design inputs.

There has been a surge of interest in craft over the past 15 years (Ferris, 2009) from the developed world and urban areas in the developing world. Higher incomes among consumers in these segments allow them to look beyond meeting basic needs to purchasing differentiated hand-crafted products with an ethnic identity (United Nations Development Organization, 2002). Both of these scenarios—the decline of rural craft markets and the growth of urban ones—indicates the need and potential to reposition the place, purpose and relevance of craft in post-industrial societies (Ferris, 2009). Recent academic discourse (Plymouth College of Art, n.d.) touches upon the need to reposition craft more closely with contemporary economic, social, cultural and ecological needs, including sustainability concerns.

Most traditional craftspeople are unable to access these lucrative markets for sustainable products (Potts et al, 2010), because of the information gap. "While the 'know-how' (how to make things—knowledge and skills) exists abundantly in the traditional crafts sector, there is a severe shortfall in the 'know-what' (what to make—strategies and designs) that curtails the ability of crafts communities to survive intense competition or, better still, develop value-added solutions in a complex economic and social matrix in which they exist (Panchal & Ranjan, 1993, p. 14)." A synergistic collaboration between craft and design that centers on innovation, responding to contemporary needs, and sustainability issues seems to offer a way forward (Fig. 5.3) (Greenlees, 2013).

However, the prevailing design–craft interactions which we studied (5.4) leave craftspeople very vulnerable because they lack an equal exchange, continuity and respect for the local culture (Intellect, n.d.). Our literature review revealed several examples of top–down designer-led approaches in the craft sector, which failed to contribute to sustainability's social tenet—including the sustainability of craft communities, in terms of their income or social status (Frater, 2009). Some of these interactions were criticized for eroding the cultural capital of communities (Frater, 2009), and the ecological dimension was not addressed in most of the interactions. We concluded that there is a paucity of models which have realized the potential of craft capital being leveraged through craft–design collaborations towards tapping sustainability markets and thus influencing sustainable development. This points to an urgent need for mechanisms which can actualize craft's potential for value-added manufacturing, within the context of sustainability and sustainable development (Greenlees, 2013).

DESIGN FOR AND WITH DEVELOPING-COUNTRY MSMES DOES NOT CURRENTLY ADDRESS SUSTAINABILITY HOLISTICALLY

Our first research question asked whether design addresses sustainability holistically—considering simultaneously all of its dimensions including social, economic, ecological and cultural ones—while working with non-industrial craft-based MSMEs working with renewable materials in developing countries. Our literature review answers Research Question 1: Existing sustainability design approaches and assessment systems practice and craft–design interactions in the developing-country context do not currently address sustainability holistically. Existing sustainability design praxis in general focuses on ecological and economic dimensions. However, encouragingly, it appears to be expanding its purview to encompass social and cultural dimensions. In the case of craft-based MSMEs, the design focus and impact seems to be primarily the economic dimension. Although social and cultural priorities are cited, the extent to which they have been achieved and the means of achieving them are questionable. Existing design practice does not contain examples where design, craft and sustainability have been successfully harnessed together for holistic sustainability. Emerging scholarship and discourse is beginning to recognize design's potential and intention to position craft as a methodological framework (Ferris, 2009), through which to impact and leverage social, economic, cultural and economic sustainability (Borges, 2013). However, this potential is yet to be realized and the proposed means to realize this are few and far between.

THE RHIZOME APPROACH BUILDS ON EXISTING SUSTAINABILITY APPROACHES AND ADDRESSES SUSTAINABILITY HOLISTICALLY FOR DESIGN FOR AND WITH DEVELOPING-COUNTRY MSMES

The answer to Research Question 1 pointed to the need to empirically develop a sustainability-design approach which addressed sustainability holistically in our problem context (Research Question 2). We developed the seven-step Rhizome Approach (9.2) and the mechanisms to operationalize it—including the Rhizome Framework and the Sustainability Checklist—based on seven recurrent themes in literature with regards to the barriers to sustainable design practice (4.5). The barriers to sustainability design, the corresponding steps of the Rhizome Approach, and the proposed methods to actualize these steps are depicted in Fig. 13.1.

STEP	BARRIER	AIM	METHOD
1	Lack of knowledge about sustainability	Inform designers about sustainability, and the connections between its tenets	Provision of background reading material covering the connections between sustainability, design,material and the production-to-consumption system
2	Lack of a holistic overview of the production-to-consumption system	Sensitize designers to the systemic production-to-consumption system	Exposure visits to stakeholders of the different nodes of the value chain and production-to-consumption system
3	Failure to include sustainability at a strategic level in the overall approach	Factor sustainability into the strategic blueprint of the enterprise	Introducing a blueprint, towards which all the participants of the collaborative design process will work together collectively
4	Failure to include sustainability criteria in the design brief	Articulate sustainability criteria in the design brief so that it can be factored into the front-end design phase	Clear brief supplemented by the Sustainability Checklist to clarify desired design and their impact on each tenet of sustainability

STEP	BARRIER	AIM	METHOD
5	Lack of a collaborative design process	Provide inputs from different stakeholders towards a collaborative design process	Constant linkage and interaction with stakeholders of the production-to-consumption system during the design process
6	Lack of tools to measure holistic sustainability against indicators	Increase designers' accountability to factor sustainability into their designs and provide a tool to measure the sustainability achieved	Evaluation of the design against the Sustainability Checklist by the designer and two external evaluators
7	Failure to keep the design team in the loop during product actualization	Keep designers in the loop until final product actualization thereby retaining their responsibility for the product's sustainability	Involving the design team in all iterations of the design, up to final product actualization

Figure 13.1: Overview of the Rhizome Approach (Reubens, 2011)

We tested whether the Rhizome Approach helped designers to address sustainability in a more holistic manner through their designs. The platform for this was the Bamboo Space-Making Craft Workshop (Chapter 11) held in India in 2011, which involved design collaborations between 24 Indian designers and 24 Kotwalia craftspeople (who represented the overall client class as discussed in detail in Chapter 8) for sustainable bamboo products. At the end of the 15-day workshop, each designer–craftsperson team designed and developed a working prototype which was evaluated by three experts. While each of the sub-mechanisms of the Rhizome Approach and all of its seven steps were well received by the workshop participants, the Sustainability Checklist (Chapter 10) received a high level of interest from the participants, both as the basis of a design and as an evaluation tool. A majority of participants also indicated they would use it in the future in their sustainable design practice.

The transferability of these findings were tested through a face-validity exercise with two other groups who represented the client class—a) Vietnamese MSMEs and b) designers around the world (Chapter 12). The positive findings from these exercises indicated the answer to Research Question 2: The Rhizome Approach addresses sustainability holistically in the context of non-industrial craft-based MSMEs working with renewable materials in developing countries, and it is mindful of the pros and cons of existing sustainability design approaches.

DESIGNERS CAN LEAD THE CHANGE, BUT THEY NEED TO BE SUPPORTED

Our literature review revealed that just because tools which aim to address sustainability exist—such as the Rhizome Approach—it does not automatically mean that sustainability factors will be integrated into the product development process (Huulgaard, 2015).

Designers need support to navigate, and thereby be able to impact the complex and interlinked levels of society (Jørgensen, 2012), including the incremental levels from product-technology system to product-service system to socio-technical system to societal system (Joore & Brezet, 2015). The immediate outside envelope which impacts designers' practice of sustainability design, and from where support needs to come, is the company or organizational framework within which the designer works. Recent literature on sustainability design highlights the importance of softer aspects—including organizational structures and systems and competence building—which are not obviously and directly linked to the product development and design process, but support the implementation and use of sustainable-design tools (Boks, 2006).

Most organizations resist investing in sustainability design because, while the company pays to develop the innovation, the fruits of this investment are also leveraged by their competitors, especially if the know-how is easily accessible and if the eco-innovation is for the public good (Beise & Rennings, 2005). This reality is felt keenly by the MSME sector, whose low-tech processes, protocols and innovations are relatively easy to copy, and who do not have deep pockets and therefore need to capitalize upon all of the investments they make—including those for sustainability. Mechanisms that create push–pull effects—including through regulation (Rennings, 2000)—can play a vital role in encouraging companies to remain on the sustainability track. This validated the need for Research Question 3, which centers on mechanisms which can support and encourage the use and operationalization of the Rhizome Approach, and its constituents.

EXISTING REGULATORY MECHANISMS DO NOT DOVE-TAIL WELL WITH OUR DOMAIN

Our literature review (12.2) revealed four main types of mechanisms—hard regulation instruments, soft regulation instruments, economic instruments and communicative instruments—which encourage consumer and thereby, company behavior towards sustainability. Hard regulation and economic regulation are not suited for developing-world situations as they lack some of the key elements for regulatory instruments to function—including accurate monitoring, a working legal system and transparency (Bell & Russel, 2002). The driver for the developing-world MSMEs in our problem class to invest in sustainability design is therefore, in most cases, not existing legislation or financial incentives, but the market. The instruments which create a market pull are communicative and soft regulation instruments.

We reviewed different types of soft regulation and communicative instruments (Laurell, 2014), and selected labeling from among these, because it consists of three basic steps: a) standard-setting, b) certification, and, c) communicating the results of the assessment (Cassell & Symon, 2006). These steps allow it to span the categories of both communicative and soft regulation instruments and the range between hard command-and-control regulation and soft voluntary self-regulation depending on the strictness of the implementation. Labeling is a third-generation regulatory instrument, which promotes cooperative state-business relationships (Clinton, 1995) because, instead of punishing wrong-doers, it encourages top performers (Mil-Homens Loureio, 2011). As opposed to technology-based mechanisms, which target the manufacturing stage by outlining specific processes or technologies to be used, and performance-based mechanisms, which target the output stage by specifying outcomes to be met (Coglianese et al, 2003), labeling is a management-based mechanism which targets the planning stage (Coglianese & Lazer, 2003), in line with our argument for front-end innovation which factors in larger sustainability goals (4.2).

Currently, there are estimated to be more than 400 sustainability-aligned certification and labeling schemes spanning almost every category of consumer products, and this number is projected to be increasing rapidly (Stewart, 2010). We reviewed some of the most recognizable of these (Stewart, 2010) to check if they could provide an answer to Research Question 3. However, we found that most sustainability labeling schemes seem to focus on environmental or social aspects (Frankl et al, 2005); schemes which integrate the ecological, social and economic dimensions of sustainability and social metrics are rare (Seuring & Muller, 2008). A scheme focusing on holistic sustainability is very important to showcase the achievements of the handicraft sector, which impacts the social and cultural dimensions significantly. Therefore, we proceeded to develop a labeling scheme and the mechanisms to underpin it, through a second cycle of design and development, to answer Research Question 3.

THE HOLISTIC SUSTAINABILITY SYSTEM CAN SUPPORT AND ENCOURAGE THE USE AND OPERATIONALIZATION OF THE RHIZOME APPROACH

We further developed our Sustainability Checklist and evaluation system into the Holistic Sustainability System in a real-time context—UNIDO's branding and labeling initiative for Vietnamese handicraft MSMEs—through a participatory and iterative design process (Chapter 12). We did this by using the feedback from two Vietnamese groups (12.4) comprising of a) officials and representatives, and, b) value-chain actors to develop the system and using the feedback from a third group of actors from the Vietnamese handicraft sector value chain (12.5).

Finally, we offered the final version of our design, known as the Holistic Sustainability System (Chapter 12), which would work as the mechanism to support and encourage the use and operationalization of the Rhizome Approach and its constituents in answer to Research Question 3. Various options were designed for the graphic representation of the Holistic Sustainability Label and the Holistic Sustainability Checklist. These were evaluated through discussions with stakeholders in Vietnam, and also by administering random questionnaires at UNIDO's booth at the LifeStyle Vietnam fair. A detailed account of the final Holistic Sustainability System can be found in UNIDO's manual, *Achieving, Assessing and Communicating Sustainability: A Manual for the Vietnamese Handicraft Sector*—which is an output of our design science research's documentation-and-dissemination phase.

The Holistic Sustainability System leverages the additional time and cost investment in a holistic sustainability-aligned design process as value-addition and product-differentiation.

This added value demonstrates how the outputs of the Holistic Sustainability Assessment could be quantified and communicated, thus legitimizing sustainability efforts as credentials make the investment in sustainability worthwhile for companies. When companies see value in sustainability, they are interested in operationalizing it. This interest from companies creates a pull for designers to practice sustainability holistically by using the Rhizome Approach, thereby answering Research Question 3.

The efficacy of this mechanism is indicated by the fact that in 2015, UNIDO's beneficiary, VIETCRAFT began to operationalize the Holistic Sustainability Assessment System through a branding and labeling scheme, under the aegis of the Vietnamese Ministry of Industry and Commerce (Vietcraft Excellence, 2015). Additional validation for the efficacy of our mechanism comes from the fact that two other institutions working with handicraft MSMEs in Vietnam—the Sustainable Product Innovation (SPIN) project and the Centre for Promotion of Imports from developing countries (Centrum tot Bevordering van de Import uit Ontwikkelingslanden—CBI) approached us to include the Holistic Sustainability Assessment for their programs. In 2015, SPIN used the Holistic Sustainability Assessment for its assessments, and plans to also use it for the assessment of the larger SPIN project (Jin, 2015). Additionally, Shauna Jin, a PhD researcher at Delft University of Technology linked to the SPIN project, adapted and used the Holistic Sustainability Checklist and used the Holistic Sustainability Assessment to evaluate the outcome of her collaborative-design project for Vietnamese MSMEs (Jin, 2015). This interest, and the usage it has already translated into, indicates that Holistic Sustainability System successfully comprises an answer to Research Question 3.

13.2 THEORETICAL CONTRIBUTIONS

Design science research focuses on developing theoretical knowledge whose value extends beyond the immediate real-context test groups—in which the outputs were demonstrated and tested—to a larger research community (Gustavsen, 1993; Levin, 1993; McKay & Marshall, 2001; Susman & Evered, 1978) interested in the same problem class (2.2). Theory-building was an important part of our research, as was underpinning it through: a) the comparability of our cases, and b) a posteriori gathering of evidence for our theory, including through questionnaires.

We offer our theoretical contributions below:

FIELD OF PRACTICE-LED RESEARCH

For the field of practice-led research in the area of sustainability design in general—and in the domains of renewable materials and developing countries specifically—this thesis has contributed empirical findings based on design science research, which showcased design's potential to develop interventions which can actualize holistic sustainability. Most practice-led research takes an action-research approach. However, practice-led research which centers on design interventions—such as the work of Jin (2015), Mestre (2014), van der Lugt (2008), Diehl (2010) and Crul (2003)—though categorized as action-research, better fits with the parameters of design science research because: a) the researcher is more dominant than the client in the collaboration (Järvinen, 2012), b) the research is intended to be used beyond the context in which they were demonstrated and tested (Venable, 2009), and c) the research aims to generate new theories or design principles which can help address real problems (Plomp, 2009).

Our research demonstrates for our cases the suitability and efficacy of design science research—a design-oriented research approach which has received much attention in the area of Information Systems research, but has been used infrequently in sustainability-design research—as a research orientation for practice-led sustainability design research. Practice-led sustainability-design research often calls for an iterative and cyclical (Baburoglu & Ravn, 1992; Baskerville & Wood-Harper, 1998; Checkland, 1981; Chisholm & Elden, 1993; Coghlan, 2001), change-focused, collaborative research process which allows for the combination of theory with practice (Hult & Lennung, 1980; Rapoport, 1979; Susman & Evered, 1978)—towards offering a practical solution to the stakeholders—while simultaneously developing theoretical knowledge that would be of value to a research community (Gustavsen, 1993; Levin, 1993; McKay & Marshall, 2001; Susman & Evered, 1978). Design science research resonates with all of these. In addition to this, the significant discourse and scholarship on actualizing design science research—albeit rooted in the field of Information Systems research—affords it a methodological rigor and procedural transparency, which is still nascent in several other design-oriented research approaches.

FIELD OF SUSTAINABILITY DESIGN

For the field of sustainability design, this design science research process and findings have, for our cases, demonstrated that sustainability design can orchestrate holistic sustainability in production-to-consumption systems, in line with the agendas of both developed and developing countries. Research on sustainability design began from an eco-perspective in the developed world, where there was sufficient income and social-security but tremendous consumption. In the developing world, sustainability design has not prioritized ecological aspects. Instead, it has had a social focus, stemming from the burning problems of poverty and unemployment with which these countries grapple. By building on the body of research in the area of sustainability design interventions—including the work of Jin (2015), Mestre (2014), van der Lugt (2008), Diehl (2010) and Crul (2003)—and by basing the research on the Four Pillars (social, economic, cultural and ecological, Fig. 4.2) model, as opposed to the commonly used Three Pillars model, this research has demonstrated design's capacity to be mindful of the trade-offs between sustainability's tenets while still addressing them holistically. This core resonates with the early theories of visionaries in the field of sustainability design including Papanek (1971), Schumacher (1973) and Whitely (1993) and, more recently, theorists such as Fuad-Luke (2009) and Ranjan (n.d.).

FIELD OF DESIGN METHODOLOGY

For the field of design methodology, this research developed and trialed three methodological tools (the Rhizome Framework, Rhizome Approach, Holistic Sustainability

System) and the mechanisms to actualize them—including the Holistic Sustainability Checklist, Holistic Sustainability Assessment and Holistic Sustainability Label—which can be used independently or interdependently towards actualizing craft–design collaboration towards sustainability, and for sustainability design in general. These outputs were developed by piecing together bits of precedents in practice and scholarship including the work of Crul and Diehl (2006) and Ideo's *A-B-C-D Approach to Making Better Products* (White et al, 2008). They were then trialed and studied for transferability—including through testing by practitioners and through the review of representatives from international institutions such as UNIDO, academic institutions such as CEPT University's DICRC, and projects such as SPIN. The DICRC used the Rhizome Approach in its first space-making craft workshop (Design Innovation and Craft Resource Center, 2013), and used the learning to create a methodology called the Ideas Model (Design Innovation and Craft Resource Center, 2015).

FOR THE FIELD OF COLLABORATIVE CRAFT–DESIGN INNOVATION

As a contribution to collaborative innovation, especially in the realm of craft–design innovation, our Rhizome Approach offered a model for collaborative innovation. There has been emerging discourse and scholarship among various forums—including the *Making Futures* conferences (Plymouth College of Art, n.d.), *Craft + Design Enquiry* journal (Craft + Design Enquiry, n.d.), *Craft Research Journal* (Intellect, n.d.)—on the potential of craft–design collaborations towards sustainability. However, the information and knowledge on actualizing craft–design collaboration towards sustainability is limited in theory and practice. The lack of such methodological tools is apparent in recent appeals—including from scholars such as Ferris (2009), Tonkinwise (2015), Murray (2010), and Greenles (2013) — for such methodologies and frameworks to be developed. Earlier precedents towards sustainability in the case of renewable materials, developing countries and craft—including the work of Jin (2015), Mestre (2014), van der Lugt (2008) and Diehl (2010)—have focused on designer-centric innovation. This research drew upon examples in praxis where the contribution of craft was acknowledged, lauded and leveraged—including the work of Frater (2016), Rhodes (2011), Dempf (Murray, 2010) and Marchand (2011).

FOR THE FIELD OF COLLABORATIVE INNOVATION

Our research also drew on, and contributed to, collaborative innovation and social innovation theory. Collaborative innovation is commonly practiced by businesses, especially in the field of information and communication technology (Emden et al, 2006), but research on the intersection of collaboration and social innovation is limited (Christensen et al, 2006). We agree with the emerging scholarship, such as the work of Halme (2015), Bhaduri (2016), Ranjan (n.d.) and Gupta (2009), which talks about the value of which non-traditional innovation partners from the developing world can bring to developed-developing partner co-creation. We also concurr with Fulencio (2012), who states that collaborative innovation has a role in addressing societal issues, and also with Cisneros (Technology Innovation Hub, n.d.), who argues that the collaborative innovation process has a social value of its own and is the means to a fulfilling life. Our literature review pointed out that craftspeople are often vulnerable in design–craft exchanges, and we therefore outlined the unique and important contribution that both designers and craftspeople bring to the innovation process, leading to the development of the Rhizome Approach to maximize each party's contribution. This is in line with Brass et al's (2004) social exchange theory, which argues for a fair bidirectional exchange so that, over time, mutually rewarding transactions and interdependent relationships can develop (Cropanzano & Mitchell, 2005).

13.3 JUXTAPOSITION OF KEY FINDINGS IN THE CONCEPTUAL FRAMEWORK AND REFLECTIONS THEREON

In Chapter 6, we developed our conceptual framework, based on the literature review in Chapters 3, 4 and 5, and our analysis thereon. We offer a juxtaposition of the key findings from our design-and-development phase with our conceptual framework in Fig. 13.2.

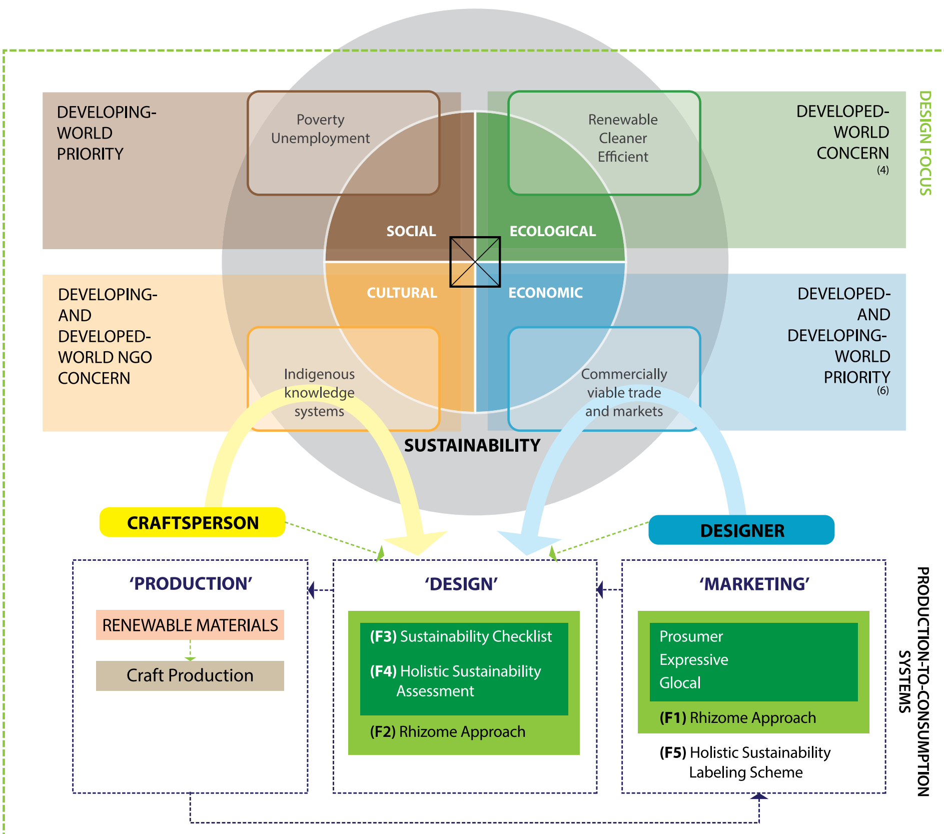

Figure 13.2: Juxtaposition of key findings with conceptual framework (Reubens 2016)

NARRATIVE EXPLANATION OF DIAGRAM

From the original conceptual framework:

- We depict sustainability as resting on production-to-consumption systems.
- Sustainability has four dimensions, each of which is prioritized by different factions as indicated in the diagram.
- The designer and craftsperson both have a unique contribution to the innovation process—the designer brings knowledge about markets and the craftsperson indigenous knowledge (green dotted arrows).

From our empirical research:

- We show through the empirical research how our design focus expands to encompass all of the elements in the diagram. Design looks at the traditional functions of production, design, and marketing, all of which are written in inverted commas to emphasize their traditional perception and scope. Design also factors in all of the dimensions of sustainability.
- The main outputs of the design-and-development phase of this research—the Rhizome Approach, and Rhizome Framework (green boxes) and the Holistic Sustainability Labeling Scheme (violet box) are indicated, and their sub-elements are represented in dark green boxes.
- The diagram depicts how inputs from the craftsperson and the designer are the basis for what is traditionally considered the design function, and how this design is crafted using renewable materials in line with the directions outlined by the Rhizome Framework.
- The final products are assessed, and the results are communicated through the Holistic Sustainability Labeling Scheme.

SUMMARY OF KEY FINDINGS

In the context of non-industrial craft-based MSMEs in developing countries working with renewable materials—

- **F1:** A framework which provides direction to the ends and means of actualizing design–craft collaboration towards holistic sustainability—in this case, the Rhizome Framework which identifies three viable directions and means of realizing them for traditional craft—facilitates the development of holistically sustainable products and production-to-consumption systems.
- **F2:** A flexible, step-by-step approach based on collaborative innovation—in this case, the Rhizome Approach—can empower designers to leverage craft production-to-consumption systems in developing countries for sustainability design, while simultaneously addressing sustainability's dimensions holistically.
- **F3:** An adaptable checklist which maps a life-cycle analysis to a four-pillar approach—in this case, the Holistic Sustainability Checklist—is an efficient and appropriate design tool to clarify desired design decisions, and their impact on each tenet of sustainability, from the front-end innovation onwards in the design process.

• **F4:** A relative sustainability evaluation method—in this case, the Holistic Sustainability Assessment—which evaluates against an adaptable checklist, which maps a life-cycle analysis to a four-pillar approach, is an efficient and appropriate tool to assess holistic sustainability.
• **F5:** A labeling scheme which communicates the result of the Holistic Sustainability Assessment in an easy-to-understand manner—in this case, the Holistic Sustainability Label—is a driver for sustainability design and marketing and for sustainable production-to-consumption systems to remain on the sustainability track.

13.4 FUTURE RESEARCH AND LIMITATIONS

Our research of seven years spanned several diverse and discrete variables—including craft, sustainability, design and developing countries. Such a broad-based field of inquiry was necessary because the interconnections between the variables were as important as the variables themselves, owing to the panoptic nature of the inquiry. Delimitations which kept the research focused and manageable included our selecting representatives for the client class—the Kotwalia community and Vietnamese MSMEs. Though these delimitations made the research more feasible and transparent, and allowed for deeper research, they also inherently defined the domain to which the outputs and findings would be most relevant—namely, the handicraft sectors in Vietnam and India, and bamboo craft in particular. While the relevance of the research findings and outputs to these specific representatives of the client class is evident, they can also be potentially extended to the larger client class and other contexts in the area of sustainability and design in general.

In terms of materials, although the main empirical research focused on bamboo through the workshop in India, the research outputs and findings are also potentially relevant to both non-industrial/craft and industrial materials, as demonstrated during the second phase of the empirical research with five handicraft value chains in Vietnam. In our second design iteration, we explored non-industrial/craft materials to an extent by virtue of the Holistic Sustainability System and its constituents being designed in the context of the handicraft value chains UNIDO was working with—including rattan, sea-grass and hand-made paper. The SPIN project also applied the Holistic Sustainability Assessment to non-industrial/craft materials apart from bamboo—including water hyacinth, hardwood and rattan (Jin, 2015). While Jin used the Holistic Sustainability Assessment for products made from MDF waste which can be considered an industrial material, this does not do justice to the opportunity to apply the research findings and outputs in context to industrial materials. Therefore, this presents an avenue for further research.

In terms of sectors, though the main empirical research focused on the handicraft sector in developing countries, the research outputs and findings are also potentially relevant to other sectors being addressed by sustainability design, in both developed and developing countries. Several individuals and institutions from sectors apart from handicraft have expressed interest in the Rhizome Approach and Holistic Sustainability System in the context of developing countries and the base of the pyramid. The *Parsons Journal of Design Strategies* issue on Designing for Billions (Reubens, 2013) published our article on the

Rhizome Approach, in which we discussed its relevance for non-industrial MSMEs working with natural materials. We have also contributed a chapter on the Rhizome Approach—as a methodology towards facilitating holistically sustainable design, especially design for and in developing country contexts—in *The Routledge Companion to Design Studies* (Reubens, 2016). Both of these indicate a wider sectoral audience for the research outputs and findings, and point to research avenues centered on the use and adaptation the research outputs and findings for mainstream sustainability design in developing-country scenarios. It also points to the transferability of our approach to other sectors. Adapting and trialing the research findings for sustainability design in developed countries is another research opportunity.

In terms of format of use, the outputs of our research were designed to be flexible, adaptable, and independent and interdependent within the set of outputs. Further inquiry into how the outputs of this research can be used to complement and supplement other sustainability approaches outside the set of this research's outputs is a potential avenue of future research. One venture into this area is Jin's use of the Holistic Sustainability Assessment alongside the EVR for the evaluation of the products developed through her research with the SPIN project (Jin, 2015), along the logic that each research method offered a different and valuable perspective.

As discussed in the beginning of this section, this research and its outputs were circumscribed within a set of delimitations. While the outputs are designed to be flexible and adaptable, the adaptations necessary to make the outputs suitable for different contexts merit future research. The Holistic Sustainability Assessment is designed such that the weightage can be customized for each tenet and criterion, and criteria can be added. Jin critiqued the default number of criteria per tenet and the limited criteria which addressed the intangible value that design can add (Jin, 2015). In line with this feedback, developing the Holistic Sustainability Checklist further—so that the criteria per tenet and vis-à-vis the lifecycle stages are equitable, balanced and comprehensive—merits future research.

We presented the key findings from the design-and-development phase of our research (F1–F5) in Figure 13.2. While we tested their relevance for our problem class through our empirical research, this is not proof enough that the approach will work. It is necessary to trial the approach in different scenarios in order to have sufficient data to compare vis-à-vis our problem class. Reviewing the outcomes of applications of our approach against different parameters—such as acceptance by designers demonstrated by a shift to our approach from mainstream design approaches, positive impact for craftspeople including socio-economic growth and enrichment of their cultural capital—will be the basis for the validation of our approach. Therefore, trialing our approach, and comparing trials of our approach to: a) validate it, or, b) create new iterations is an avenue of further research.

13.5 CLOSING THOUGHTS

The sustainability playing field is a great leveler. Given the limited and evolving knowledge on sustainability—and the urgent need to act immediately despite the knowledge limitation—every potential solution and solution provider needs to be considered. This situation has thrown up unlikely potential heroes and champions. The unlikely champions of this research have been craftspeople, who have generally been viewed as potential recipients of hand-holding and handouts from urban value-chain supporters, including designers in the developing and developed worlds. However, given that sustainability design is a new discipline, and the knowledge to be transferred through hand-holding is still being generated, these players have an edge on innovation towards sustainability on two counts—a) by virtue of coming from a background which is still not completely globalized and subjected to division of labor, and therefore being inherently better able to grasp the compound picture and systems thinking; and b) by virtue of constantly needing to quickly evolve a Plan B for the several instances when the social and state systems in developing countries fail them, which has led to their possessing the ability to quickly internalize and respond to crises in flux—which is exactly what the sustainability crisis requires.

Craftspeople are the keepers of indigenous systems, which have much to offer to sustainability praxis by way of a localized knowledge base and systems which have proven over time to be more sustainable than not. This research has worked to devise a way to include them, and their knowledge, into the sustainability-centric innovation process. Throughout this process, we have been mindful of Aristotle's wisdom in noting that the worst form of inequality is to try and make unequal things equal. Therefore, this research has not focused on comparing or attempting to equalize craft and design. Instead, it has centered on finding an equitable path through its outputs, especially the workshop design, to ensure that craft and design both have their own contribution, due, and place to work together towards sustainability.

Also on the note of forcing equality between unequals is the demand of developing countries to rightfully pursue the development trajectory of developed countries, and the expectation of developed countries that developing countries comply with sustainability compliance frameworks developed in the context of developed countries. In our opinion, both set of expectations and demands are unfair and unrealistic. The adage of thinking globally and acting locally seems to offer a way forward—systems need to be adaptable locally but adhere to minimum global compliance in their essence and key criteria.

Hearteningly, this research seems to indicate that designers can practice sustainability design—even holistic sustainability design—if shown why and how. Through disruptive innovation, design can create and highlight spaces for change, in that which it cannot change. However, design can only do so much—designers function in an eco-system like the rest of the world. Design needs a facilitating environment and agencies, including policy, legislation, and education. At the end of the day, everybody needs to be on board. Everybody counts. As stated in the opening of this section: The sustainability playing field is a great leveler.

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ANNEXURES

ANNEXURE 1: BAMBOO SPACE MAKING CRAFT WORKSHOP QUESTIONNAIRE 1

INDIVIDUAL QUESTIONNAIRE for Rhizome Approach
20th January, 2010
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

BACKGROUND

1. Background
   a) Name   b) Age
   c) Sex   d) E-mail address

2. Current position (Please circle)
   a) Undergraduate Design Student   b) Postgraduate/Master's Design student
   c) Professional

3. Professional Educational Background (Please circle)
   a) Architecture   b) Industrial design
   c) Engineering   d) Craft design
   e) Other (Please specify)

VIEWS ON SUSTAINABILTY

4. How familiar are you with concepts relating to sustainability? (Please circle)
   a) Very   b) Somewhat
   c) Barely   d) Not at all

5. How familiar are you with concepts relating to sustainable design? (Please circle)
   a) Very   b) Somewhat
   c) Barely   d) Not at all

6. Which of the below do you relate to the concept of sustainability? (Rank the options you find relevant in order of priority)
   a) Preserving the environment
   b) Preserving biodiversity
   c) Rural development
   d) Fair Trade
   e) Cleaner products
   f) Craft conservation
   g) Heritage conservation
   h) Sustainable development

i) Recycle, renew, reuse
j) Green design
k) Ecodesign
l) Gender-friendly
m) Other (Please specify)

7. Which of these sustainability related models do you know about? (Please circle)
a) Ecodesign
b) Triple bottom line
c) Four pillars model
d) Five capitals model e) None
e) Other (Please specify)

8. Which aspects do you think to be considered while designing sustainably? (Rank the options you find relevant in order of priority)
a) Ecological
b) Social
c) Cultural
d) Economic
e) Ethical
f) Political
g) Other (Please specify)

9. Sustainable design should consider… (Circle the options you find relevant and rank the Top 10 in order of priority)
a) Cleaner material
b) Renewable material
c) Low energy-consumption
d) Biodegradable material
e) Recyclable material
f) Recycled material
g) Material that is supplied by poor/marginalized/local producers
h) Fairly traded material
i) Sustainably harvested and managed material
j) Minimally treated and processed material
k) Material which has been traditionally used by local/indigenous communities
l) Use of minimum material possible in the product
m) Less harmful/sustainable combination materials
n) Indigenous treatments and processes
o) Production which has less emissions
p) Minimum production steps
q) Use of renewable energy for production
r) Generation of less waste and efficient waste management
s) Material reduction through efficient production systems
t) Healthy and safe working environment for producers
u) Fair wages and benefits to producers
v) Non-discriminatory production system
w) Employment to marginalized producers
x) Capacity building of producers
y) Involving producers in decision-making
z) No child and forced labor
aa) Respect for human rights of producers
bb) Indigenous representation in decision-making where indigenous resources are used
cc) Minimum product weight
dd) Reduction in distribution volume/weight
ee) Minimum packaging
ff) Clean/cleaner packaging
gg) Recyclable packaging

hh) Packaging made from reused/recyclable material
ii) Energy efficient transport for distribution
jj) Localized production and distribution systems to reduce physical production to delivery cap
kk) Low energy-consumption during usage
ll) Reduction of disposable auxiliary materials through permanent product feature
mm) Efficient use of consumable during usage
nn) Use of clean consumable during usage
oo) Safe for users' health
pp) Customizable product
qq) User-friendly product
rr) Affordable product
ss) Easy-to-maintain and repair product
tt) Affordable product
uu) Easily upgradeable product
vv) Classic design
ww) Products which promote a strong user–product relationship
xx) Locally repairable and maintainable product
yy) Product which can easily be disassembled
zz) Product made from mono or single material
aaa) Recyclable product
bbb) Product where harmful parts are easily isolatable for separate disposable
ccc) Products which create employment of local communities through recycling
ddd) None of these
eee) Other (Please specify)

10. The aim of sustainable design is… (Rank the options you find relevant in order of priority)
a) To increase sales and business
b) To preserve the environment
c) To ensure fair wages to producers
d) To redistribute wealth more equitably
e) To ensure fair trade
f) To conserve culture
g) To prevent child labor
h) To provide better working conditions for labor
i) To provide fair opportunities to all
j) To reduce pollution
k) To address global warming
l) Other (Please specify)

11. Which of these aspects need to be considered while designing sustainable? (Rank the options you find relevant in order of priority)
a) Material selection b) Material production and processing
c) Fabrication d) Distribution
e) Use f) End-of-life handling
g) Other (Please specify)

PRACTICE
12. How much is sustainability part of the design projects done by you? *(Please circle)*
a) Every project b) Most projects
c) Some projects d) No projects

13 To what extent did you receive inputs on sustainability during your design education (Please circle)

a) Frequently b) Occasionally
c) Rarely d) Never

14 What have been your main sources of information on sustainability and sustainable design? *(Rank the options you find relevant in order of priority)*

a) Personal research b) Media/ articles
c) Clients d) Colleagues
e) Courses and studies f) Other (Please specify)

15 What percentage of professionals in your profession do you think routinely incorporate sustainable elements in their practice? (C*ircle nearest)*

a) 10% b) 20% c) 30% d) 40% e) 50% f) 60%
g) 70% h) 80% i) 90% j) 100%

16 What percentage of students in your profession do you think routinely incorporate sustainable elements in their practice? (*Circle nearest)*

a) 10% b) 20% c) 30% d) 40% e) 50% f) 60%
g) 70% h) 80% i) 90% j) 100%

17 Which of these aspects do you consider when designing? *(Rank the options you find relevant in order of priority)*

a) Material selection
b) Product development
c) Material production and processing
d) Fabrication
e) Distribution
f) Use
g) End-of-life handling

18. Which of these factors hinder you from designing sustainably? *(Rank the options you find relevant in order of priority)*

a) Lack of training/education in sustainable design
b) Lack of including sustainability criteria alongside traditional criteria as a design parameter in the design brief
c) Lack of interest in sustainability from the project team, e.g., prototypers, producers, etc.
d) Lack of access to information on sustainability statistics and data
e) Sustainable design means more expensive products
f) Lack of green material suppliers
g) Lack of holistic oversight of the production-to-consumption chain
h) Lack of collaborative design process
i) Lack of tool to measure sustainability against indicators
j) Lack of control over final product because on limited involvement in the actual product realization
k) Others (Please specify)

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 2: BAMBOO SPACE MAKING CRAFT WORKSHOP QUESTIONNAIRE 2

INDIVIDUAL QUESTIONNAIRE for Rhizome Approach
28th January, 2010
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Name: **E-mail address:**

BAMBOO RESOURCE

1. Where does the bamboo the Kotwalia community use come from? *(Rank the options you find relevant in order of priority)*
   a) Their own clumps_____ b) farmers_____ c) forest_____
   d) common land_____ e) traders_____ f) other (Specify) _____

2. What is the availability of bamboo to the craftspeople? *(Please circle)*
   a) High b) Adequate c) Low d) Not available

3. Do the craftspeople harvest bamboo from common or community land? *(Please circle relevant options)*
   a) Free and with permission b) On payment and permission
   c) Free and without permission d) Not at all
   e) Other (Specify)

4. Do the craftspeople harvest bamboo from government forests? *(Please circle)*
   a) Free and with permission b) on payment and permission
   c) Free and without permission d) Not at all e) Other (Specify)

5. Does the forest department supply the Kotwalia community with bamboo? *(Please circle relevant options)*
   a) Green bamboo b) Mature bamboo
   c) No bamboo d) Both
   e) Other (Specify)

6. What kind of bamboo does the Kotwalia community use the most for traditional products? *(Please circle relevant options)*
   a) Green bamboo b) Mature bamboo
   c) Both d) Other(Specify)

TRANSPORTATION

7. How does the Kotwalia community transport bamboo? *(Please circle relevant options)*
   a) Carry it themselves b) Private transporters
   c) Government d) They do not transport bamboo
   e) Other (Specify)

DESIGN AND INNOVATION

8. Who designs and innovates the products produced by the Kotwalia Community? *(Rank the options you find relevant in order of priority)*
   a) Kotwalia community through open source/traditional craft tradition
   b) Traditional user or patron
   c) Design consultants
   d) Sustainable/social design firms
   e) Design institutions
   f) Government
   g) Other (Please specify)

PROCESSING

9. Who all in a Kotwalia family are involved in bamboo craft? *(Circle relevant options)*
   a) Men b) Women c) Children

10. How much time do you think a craftsperson spends for making bamboo, in hours per day on an average **(***Circle relevant options)*
   a) 1–2 hours b) 2–4 hours c) 4–6 hours d) 6–8 hours
   e) More than 8 hours f) Other (Specify)

11. Among the family, who does the following with Bamboo? (*Fill a, b, c, etc.)* men__________ women__________children_________
   a) Harvesting b) Splitting c) Slivering d) Interlacing/weaving
   e) Finishing f) Coloring g) Marketing

12. What treatment is done to bamboo traditionally? *(Circle relevant options)*
   a) Smoking b) Water soaking c) Painting d) Varnishing
   e) Other (Specify)

13. What treatment is done to bamboo in non-traditional set-ups in the Dangs? *(Circle relevant options)*
   a) Smoking b) Water soaking c) Painting
   d) Varnishing e) Other (Specify)

14. *Kotwalia craftspeople work as part of* __________**.** *(Circle relevant options)*
   a) Community b) Group c) Family
   d) As an individual e) other (Specify)

15. How do the Kotwalia craftspeople learn bamboo craft *(Circle relevant options)*
   a) Generational b) Training/workshop
   c) Other (specify)

16. Are the Kotwalia craftspeople teaching the craft to someone? *(Circle relevant options)*
   a) No b) Yes *If yes, to whom?* c) Own children
   d) Other (Specify)

17. Are you the Kotwalia craftspeople still doing as much bamboo craft today as they were in the past? *(Circle relevant options)*
   a) Same b) Reduced c) Discontinued d) Other (Specify)

MARKETING AND SELLING

18. Where do the Kotwalia craftspeople sell their products? *(Circle relevant options)*
   a) Within the village b) Nearby villages
   c) Town d) Tourist places
   e) Other (Specify)

19. What is the mode of marketing? *(Circle relevant options)*
   a) Direct b) Middlemen c) Order d) Other (Specify)

PARTICIPANT EXPERIENCE FEEDBACK

20. Did your visit to the Kotwalia community village enable you to understand their production-to-consumption value chain more clearly and thoroughly than before the visit?

a) Yes b) No

c) Did not make any difference d) Other (Specify)

21. Do you feel that there are differences between industrial and non-industrial or craft set-ups in terms of production, design requirements and potentials, etc.?

a) Yes b) No c) Not sure d) Other (Specify)

22. If you answered "yes" to question 21, was the visit to the community helpful in understanding the difference between industrial and non-industrial or craft set-ups?

a) Yes b) No c) Did not make any difference d) Other (Specify)

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 3: BAMBOO SPACE MAKING CRAFT WORKSHOP QUESTIONNAIRE 3

INDIVIDUAL QUESTIONNAIRE for Rhizome Approach
1st February, 2010
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Name: E-mail address:

RHIZOME FRAMEWORK

1. Do you feel the three directions developed through the Rhizome framework i.e. prosumer, expressive, and glocal are relevant directions for craft? *(Please circle)*
a) Yes b) No c) Not sure d) Other (Specify) _____

2. Is there any other direction that you feel should be included as a possible direction for craft? *(Please circle)*
a) Yes b) No c) Not sure If yes, please specify_____

3. How helpful was the product library in understanding the basic level of products and skill available within the craft practice? *(Please circle relevant options)*
a) Very b) Somewhat c) Barely d) Not at all

4. How much did the lack of a comprehensive formal documentation of the craft of this community hinder your design process with the craft? *(Please circle)*
a) Very much b) Somewhat c) Barely d) Not at all

5. Did the brainstorming exercise regarding the systems effect of your direction, i.e., expressive, glocal or prosumer, help you to see the larger picture at a strategic level? *(Please circle)*
a) Very much b) Somewhat c) Barely d) Not at all

6. Was the designer-group brainstorming exercise on the possible products that can be developed through each direction, i.e., expressive, glocal or prosumer, helpful to you in seeing new product possibilities you would not have considered on your own? *(Please circle)*
a) Very much b) Somewhat c) Barely d)Not at all

7. Was the craftspeople's group brainstorming exercise on the possible products that can be developed through each direction i.e. Expressive, glocal or prosumer helpful to you in seeing new product possibilities you would not have considered on your own? *(Please circle)*
a) Very much b) Somewhat c) Barely d) Not at all

8. The outcome of the craftspersons brainstorming exercise was ___________. *(Please circle)*
a) What you expected
b) Much more creative than you expected
c) Much more in touch with the market than you expected
d)Much more output that you expected
e) Much less creative than you expected
f) Much less in touch with the market than you expected
g) Much less output than you expected
h) Other (Specify)

9. How much did the icebreaking exercises, i.e., partner game, hand drawing, and finding out three things, help you and your craftsperson work as a team towards one strategic goal? *(Please circle relevant options)*

a) Very much b) Somewhat c) Barely d) Not at all

10. How much did the three things you found out about your craftsperson surprise you? *(Please circle)*

a) Very much b) Somewhat c) Barely d) Not at all

11. How similar is your craftsperson to you than what you expected? *(Please circle)*

a) Very much b) Somewhat c) Barely d) Not at all

12. Please rank the exercises which helped you work jointly with others towards one strategic goal, i.e., your product within your direction? *(Please rank relevant options)*

a) Relevance of craft exercise
b) Brainstorming about systems impact of each direction
c) Designers brainstorming about possibilities within each direction
d) Craftspersons' brainstorming about possibilities within each direction
e) Drawing hand exercise
f) Finding partner game
g) Three-secrets game
h) Other (Specify)

SUSTAINABILITY CHECKLIST

13. How useful was the checklist in understanding the different sustainability concerns and factors at each stage of the product life cycle? *(Please circle)*

a) Very b) Somewhat c) Barely d) Not at all

14. How many new factors relating to sustainability as compared to those you knew of earlier did you come to know of through the checklist? *(Please circle)*

a) A lot b) A few c) Barely any d) None

15. When did you clearly understand the checklist? *(Please circle)*

a) By reading it
b) After explanation of each factor
c) I did not understand all factors even after explanation
d) I did not understand any factors even after explanation
e) Other(Specify)

16. How helpful would a small booklet explaining each factor of the checklist be to help understand the checklist better? *(Please circle)*

a) Very b) Somewhat c) Barely d) Not at all

17. How much did you use/refer to the checklist while designing your product? *(Please circle)*

a) A lot b) Somewhat c) Barely d) Not at all

18. You would use the checklist more if _____________ *(Please circle all relevant and rank)*

a) It was shorter
b) It was more simply worded
c) It was better looking graphically
d) It was in digital format
e) It was better explained with a booklet to make each point clearer
f) You had more time to design
g) The factors in the checklist were made compulsory by the client

h) The factors in the checklist were made compulsory by the government
i) Most other designers started using the checklist as well
j) Other (Specify)

19. How much will you use the checklist when practicing sustainable design in the future? *(Please circle)*
a) A lot b) Somewhat c) Barely d) Not at all e) Other (Specify)

COLLABORATIVE INPUTS

20. How much did the input sessions from different speakers every morning help you expand your design concerns to the larger picture? *(Please circle)*
a) A lot b) Somewhat c) Barely d) Not at all e) Other (Specify)

21. How much did the informal inputs from the facilitators help you expand your design concerns to the larger picture? *(Please circle)*
a) A lot b) Somewhat c) Barely d) Not at all e) Other (Specify)

22. Please rank the relevant inputs according to how much they expanded your design concerns to the larger picture *(Please circle and rank relevant options)*
a) Rebecca Reubens: Sustainability, and the Rhizome Approach
b) Asst. Prof. Jay Thakkar: Introduction to DICRC and Space Making Crafts
c) Prof. Kireet Patel: Bamboo and standardization in interior architecture
d) Errol Reubens, Jr.: Experiences in working with bamboo for spaces; Bamboo canopy
e) Prof. M. P. Ranjan: Bamboo and sustainable development insights from design research and action
f) Asst Prof. Sankalpa: Bamboo houses
g) Mr Brij Bhasin: Marketing crafts
h) Vishal Wadhwani: Application of bamboo in structural systems
i) Ms Shiuli: Craft tradition and culture
j) Samir Parker: To craft by design
k) Dr A. K. Das: Bamboo its multiple dimensions in the material culture of the Northeast
l) Ms Sonal Mehta: Informal social inputs
m) Jay Thakkar: Informal inputs on space making and design
n) Rebecca Reubens: Informal inputs on sustainability, bamboo and design
o) Shiuli: Informal inputs on craft
p) Informal inputs from craftspersons
q) Informal inputs from master craftspersons
r) Informal inputs from other designer participants
s) Other (Specify)

23. Additional inputs in which areas do you think might help enhance the Rhizome Approach and workshop structure *(Please circle and rank relevant options)*
a) Bamboo b) Sustainability
c) Social development d) Design
e) Production f) Marketing
g) Technical h) Craft
i) None j) Other (Specify)

24. How different would your final product have been from what it is now without the collaborative process created by different inputs? *(Please circle)*
a) Very b) Somewhat c) Barely d) Not at all

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 4: BAMBOO SPACE MAKING CRAFT WORKSHOP QUESTIONNAIRE 4

FINAL QUESTIONNAIRE

3rd February, 2010

Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Name:

VIEWS ON SUSTAINABILTY

1. How familiar are you with concepts relating to sustainability? *(Please circle)*
a) Very b) Somewhat c) Barely d) Not at all

2. How familiar are you with concepts relating to sustainable design? *(Please circle)*
a) Very b) Somewhat c) Barely d) Not at all

3. Which of the below do you relate to the concept of sustainability? *(Rank the options you find relevant in order of priority)*
a) Preserving the environment
b) Preserving biodiversity
c) Rural development
d) Fair Trade
e) Cleaner products
f) Craft conservation
g) Heritage conservation
h) Sustainable development
i) Recycle, renew, reuse
j) Green design
k) Ecodesign
l) Gender-friendly
m) Other (Please specify)

4. Which of these sustainability related models do you know about *(Please circle)*
a) Ecodesign b) Triple Bottomline
c) Four Pillars model d) Five Capitals model
e)None f) Other (Please specify)

5. Which aspects do you think to be considered while designing sustainably? *(Rank the options you find relevant in order of priority)*
a) Ecological b) Social
c) Cultural d) Economic
e) Ethical f) Political
g) Other (Please specify)

6. Sustainable design should consider… *(Circle the options you find relevant and rank the Top 10 in order of priority)*
a) Cleaner material
b) Renewable material
c) Low energy-consumption
d) Biodegradable material

e) Recyclable material
f) Recycled material
g) Material that is supplied by poor/marginalized/local producers
h) Fairly traded material
i) Sustainably harvested and managed material
j) Minimally treated and processed material
k) Material which has been traditionally used by local/indigenous communities
l) Use of minimum material possible in the product
m) Less harmful/sustainable combination materials
n) Indigenous treatments and processes
o) Production which has less emissions
p) Minimum production steps
q) Use of renewable energy for production
r) Generation of less waste and efficient waste management
s) Material reduction through efficient production systems
t) Healthy and safe working environment for producers
u) Fair wages and benefits to producers
v) Non-discriminatory production system
w) Employment to marginalized producers
x) Capacity-building of producers
y) Involving producers in decision-making
z) No child and forced labor
aa) Respect for human rights of producers
bb) Indigenous representation in decision-making where indigenous resources are used
cc) Minimum product weight
dd) Reduction in distribution volume/weight
ee) Minimum packaging
ff) Clean/cleaner packaging
gg) Recyclable packaging
hh) Packaging made from reused/recyclable material
ii) Energy-efficient transport for distribution
jj) Localized production and distribution systems to reduce physical production to delivery cap
kk) Low energy-consumption during usage
ll) Reduction of disposable auxiliary materials through permanent product feature
mm) Efficient use of consumable during usage
nn) Use of clean consumable during usage
oo) Safe for users' health
pp) Customizable product
qq) User-friendly product
rr) Affordable product
ss) Easy to maintain and repair product
tt) Affordable product
uu) Easily upgradeable product
vv) Classic design
ww) Products which promote a strong user–product relationship
xx) Locally repairable and maintainable product
yy) Product which can easily be disassembled
zz) Product made from mono or single material
aaa) Recyclable product
bb) Product where harmful parts are easily isolatable for separate disposable
ccc) Products which create employment of local communities through recycling
ddd) None of these
eee) Other (Please specify)

7. The aim of sustainable design is… *(Rank the options you find relevant in order of priority)*
  a) To increase sales and business
  b) To preserve the environment
  c) To ensure fair wages to producers
  d) To redistribute wealth more equitably
  e) To ensure fair trade
  f) To conserve culture
  g) To prevent child labor
  h) To provide better working conditions for labor
  i) To provide fair opportunities to all
  j) To reduce pollution
  k) To address global warming
  l) Other (Please specify)

8. Which of these aspects need to be considered while designing sustainably? *(Rank the options you find relevant in order of priority)*
  a) Material selection
  b) Material production and processing
  c) Fabrication
  d) Distribution
  e) Use
  f) End-of-life handling
  g) Other (Please specify)

PRACTICE

9. Which of these aspects do you consider when designing? *(Rank the options you find relevant in order of priority)*
  a) Material selection
  b) Product development
  c) Material production and processing
  d) Fabrication
  e) Distribution
  f) Use
  g) End-of-life handling

10. Which of these factors hinder you from designing sustainably? *(Rank the options you find relevant in order of priority)*
  a) Lack of training/education in sustainable design
  b) Lack of including sustainability criteria alongside traditional criteria as a design parameter in the design brief
  c) Lack of interest in sustainability from the project team, e.g., prototypers, producers, etc.
  d) Lack of access to information on sustainability statistics and data
  e) Sustainable design means more expensive products
  f) Lack of green material suppliers
  g) Lack of holistic oversight of the production-to-consumption chain
  h) Lack of a collaborative design process
  i) Lack of tools to measure sustainability against indicators
  j) Lack of control over final product because on limited involvement in the actual product realization
  k) Other (Please specify)

EVALUATION

11. How difficult was it for you to evaluate yourself against the Sustainability Checklist you from designing sustainably? *(Please circle)*
  a) Very   b) Somewhat   c) Barely   d) Not at all

12. How much do you think your design can be improved with regards to sustainability after the self-evaluation process? *(Please circle)*

a) Very much b) Somewhat c) Barely d) Not at all

13. How useful was the evaluation process with the other two evaluators for you to rethink your design with regards to sustainability? *(Please circle)*

a) Very b) Somewhat c) Barely d) Not at all

14. Whose evaluation made you consider changes to your product to make it more sustainable? *(Please circle and rank relevant options)*

a) Self b) Community representative c) External expert

15. How can evaluation using the checklist be easier? *(Please circle and rank relevant options)*

a) Checklist can be made digital
b) Checklist can be made shorter
c) Checklist can be made clearer
d) Checklist can ask specific questions completely, eg., "Is your product made from a single material?" instead of mentioning "mono-material"
e) Other (Specify)

16. How would you use the checklist in the future? *(Please circle)*

a) Would not use it in the future
b) Would use it to formulate design brief
c) Would use it formulate design brief and also to evaluate design
d) Other (Specify)

17. If a final version of your prototype is going to be made, would you like to make changes? *(Please circle)*

a) No changes
b) Know what changes you want
c) You want changes, but you want technical and other inputs from experts before you freeze them
d) You are ok with passing the prototype as it is to experts who will make changes without informing you and complete the prototype
e) Other (Specify)

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 5: BAMBOO SPACE MAKING CRAFT WORKSHOP:

LIST OF DESIGN PARTICIPANTS

SR. NO	NAME OF PARTICIPANT	INSTITUTION	BACKGROUND
1	Anusha Yashwant Babel	MIAD, SID, CEPT	P.G. Student
2	Devanshi Das	MIAD, SID, CEPT	P.G. Student
3	Gaurav Rajender	MIAD, SID, CEPT	P.G. Student
4	Harshita Raju	MIAD, SID, CEPT	P.G. Student
5	Krutika Ghawghawe	MIAD, SID, CEPT	P.G. Student
6	Mihir Vakharia	MIAD, SID, CEPT	P.G. Student
7	Mitraja Jatin Vyas	MIAD, SID, CEPT	P.G. Student
8	Namrata Thyagraj	MIAD, SID, CEPT	P.G. Student
9	Neeraj Richard Bara	MIAD, SID, CEPT	P.G. Student
10	Rishav Jain	MIAD, SID, CEPT	P.G. Student
11	Sangeetha Priya	MIAD, SID, CEPT	P.G. Student
12	C. Shree Sowmya	MIAD, SID, CEPT	P.G. Student
13	Vrushali Babanrao Burlee	MIAD, SID, CEPT	P.G. Student
14	Niharika Shrivastava	F & ID, IICD	P.G. Student
15	Kartick Ghosh	F & ID, IICD	P.G. Student
16	Mohammed Wasif Ahsan	F & ID, IICD	P.G. Student
17	Tillotam Kumar Baraik	F & ID, IICD	P.G. Student
18	Manu Narendran	SBST, CEPT	Master’s Student
19	Rachna Ahuja	Freelance professional	Architect
20	Neha Singh	SID, CEPT	Interior designer
21	Bhavin Panchal	SA, CEPT	Master’s Student
22	Rajesh Rasania	Abbelon Clean Energy	Civil Engineer
23	Gaurav Jain	SID, CEPT	Interior design student
24	Neha Vaid	SID, CEPT	Interior design student

ANNEXURE 6: BAMBOO SPACE MAKING CRAFT WORKSHOP:

LIST OF CRAFT PARTICIPANTS

SR. NO.	NAME OF PARTICIPANT
1	Kamlesh Babu
2	Sheela Kotwalia
3	Rajesh Nanu
4	Ranjeeta Kumari
5	Ambubhai Babu
6	Sunita Kumari
7	Saleem Shankar
8	Ripka Aggarwal
9	Prakash Soma (Bunty)
10	Sakruben Ambubhai
11	Dhiru Karsanbhai
12	Daniel Kotwalia
13	Sanjay Kanubhai Gamit
14	Rajesh Chotubhai
15	Jayesh Mansu
16	Ethail Ishwar
17	Bipin Arvind
18	Jay Singh
19	Naresh Masha
20	Laxman Nausar
21	Ashok Laloobhai
22	Dilip Ishwar
23	Navin Supadia
24	Ratan Chandra Pal

ANNEXTURE 7: BAMBOO SPACE-MAKING CRAFT WORKSHOP:

LIST OF WORKSHOP FACILITATORS

SR. NO.	NAME OF FACILITATOR	INSTITUTION	BACKGROUND
1	Jay Thakkar	DICRC	Assistant Professor
2	Sonal Mehta	Eklavya Foundation	Executive Director
3	Shiuli Mahato	IICD	Assistant Professor
4	Rebecca Reubens	T U Delft	PhD Researcher

ANNEXURE 8: BAMBOO SPACE MAKING CRAFT WORKSHOP:

WORKSHOP EXERCISES

Animal Couples:[1] This exercise was aimed at icebreaking and energizing, and also at forming innovation teams comprising one craftsperson and one designer each. The game is based on a common children's party game, and was played by creating two sets of paper chits, each containing an animal name. One set was distributed to the craft participants, and the other to the design participants. Each designer had to find his partner craftsperson and vice-versa, identifying them only through animal sounds. The pair that gets together first wins the game.

Three Secrets: This exercise was aimed at icebreaking and team-building, and was developed based on the 'My Favourite' exercise.[2] The exercise involved each designer–craftsperson innovation team learning three 'secrets' about their teammate by conversing with them. These secrets could involve little-known facts about their teammate, ranging from their goal in life, to their favorite food. The process facilitates discussions and confidence-building. Each participant then introduced their partner to the rest of the innovation groups using the three secrets as an introduction point.

Draw Your Hand: This exercise was aimed at team-building, and was adapted from the community-profiling exercises developed by the InHand Abra Foundation in the Philippines. The exercise involved each participant drawing their non-dominant hand. Each participant could be assisted by his/her teammate who could help them in any manner, except in drawing. The process allowed the participants to discover the skills of their partner, while encouraging and providing feedback to their partner on improving the drawing or, in some cases, helping a shy teammate complete the activity. The drawings provided insight into the traits of the artist—a detailed drawing depicted attention to detail, a drawing larger than the actual hand indicated an amplified image of oneself, and a drawing smaller than the actual hand indicated low self-esteem. The drawings were analyzed by the facilitators and the pertinent observations were shared with the group. This helped teammates have a better insight into the psyche and working style of their partners and themselves.

[1] Association des Etats Generaux des Etudiants de l'Europe (AEGEE) (2014). *Eco-Games*. Retrieved from http://www.projects.aegee.org/suct/su2014/files/cooperations/Eco-Games.pdf

[2] Morable, L. (2000). Using Active Learning Techniques: Teal Compendium. Texas: Richland College.

ANNEXURE 9: VALIDATION: PREWORKSHOP QUESTIONNAIRE

INDIVIDUAL QUESTIONNAIRE for Rhizome Approach 1
May, 2011
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

BACKGROUND

1. Background
   a) Name: b) Age:
   c) Sex: d) E-mail address:

2. Current position *(please circle)*
   Undergraduate Student b) Postgraduate/Master's student
   c) Professional d) Other

3. Professional Educational Background *(Please circle)*
   Architecture b) Industrial design
   c) Engineering d) Craft design
   e) Other (Please specify)

VIEWS ON SUSTAINABILTY

4. How familiar are you with concepts relating to sustainability *(Please circle)*
   Very b) Somewhat c) Barely d) Not at all

5. How familiar are you with concepts relating to sustainable design *(Please circle)*
   Very b) Somewhat c) Barely d) Not at all

6. Which of the below do you relate to the concept of sustainability *(Rank the options you find relevant in order of priority)*
   a) Preserving the environment
   b) Preserving biodiversity
   c) Rural development
   d) Fair Trade
   e) Cleaner products
   f) Craft conservation
   g) Heritage conservation
   h) Sustainable development
   i) Recycle, renew, reuse
   j) Green design
   k) Eco-design
   l) Gender-friendly
   m) Other (Please specify)

7. Which of these sustainability related models do you know about? *(Please circle)*
   a) Ecodesign b) Triple bottomline c) Four Pillars model
   d) Five Capitals model e) None f) Other (Please specify)

8. Which aspects do you think to be considered while in sustainable design? *(Rank the options you find relevant in order of priority)*
   a) Ecological b) Social c) Cultural d) Economic
   e) Ethical f) Political g) Other (Please specify)

9. The aim of sustainable design is… *(Rank the options you find relevant in order of priority)*
   a) To increase sales and business
   b) To preserve the environment
   c) To ensure fair wages to producers
   d) To redistribute wealth more equitably
   e) To ensure fair trade
   f) To conserve culture
   g) To prevent child labor
   h) To provide better working conditions for labor
   i) To provide fair opportunities to all
   j) To reduce pollution
   l) To address global warming
   m) Other (Please specify)

10. Which of these aspects need to be considered while designing sustainably? *(Rank the options you find relevant in order of priority)*
   a) Material selection b) Material production and processing
   c) Fabrication d) Distribution e) Use f) End-of-life handling g) Other (Please specify)

PRACTICE

11. How much is sustainability part of the design projects done by you? *(Please circle)*
   a Every project b) Most projects c) Some projects
   d) No projects

12. To what extent did you receive inputs on sustainability during your education? *(Please circle)*
   a) Frequently b) Occasionally c) Rarely d) Never

13. What have been your main sources of information on sustainability? *(Rank the options you find relevant in order of priority)*
   a) Personal research b) Media/articles c) Clients
   d) Colleagues e) Courses and studies f) Other (Please specify)

14. Which of these factors hinder you from sustainability practice? *(Rank the options you find relevant in order of priority)*
   a) Lack of training/education in sustainability
   b) Lack of including sustainability criteria alongside traditional criteria as a design parameter in the design brief
   c) Lack of interest in sustainability from the project team, e.g., prototypers, producers, etc.
   d) Lack of access to information on sustainability statistics and data
   e) Sustainable design means more expensive products
   f) Lack of green-material suppliers
   g) Lack of holistic oversight of the production-to-consumption chain
   h) Lack of a collaborative design process
   i) Lack of tool to measure sustainability against indicators
   j) Lack of control over final product because of limited involvement in the actual product realization
   k) Others (Please specify)

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 10: VALIDATION: POST-WORKSHOP QUESTIONNAIRE

INDIVIDUAL QUESTIONNAIRE for Rhizome Approach 2
May, 2011
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Name: **E-mail address:**

RHIZOME FRAMEWORK

1. Do you feel the three directions developed through the Rhizome framework, i.e. prosumer, expressive, and glocal, are relevant directions for craft? *(Please circle)*
a) Yes b) No c) Not sure d) Other (Specify) _____

SUSTAINABILITY CHECKLIST

2. How useful was the checklist in understanding the different sustainability concerns and factors at each stage of the product life cycle? *(Please circle)*
a) Very b) Somewhat c) Barely d) Not at all

3. How many new factors relating to sustainability as compared to those you knew of earlier did you come to know of through the checklist? *(Please circle)*
a) A lot b) A few c) Barely any d) None

4. When did you clearly understand the checklist? *(Please circle)*
a) By reading it
b) After explanation of each factor
c) I did not understand all factors even after explanation
d) I did not understand any factors even after explanation
e) Other (Specify)

5. How helpful would a small booklet explaining each factor of the checklist be to help understand the checklist better? *(Please circle)*
a) Very b) Somewhat c) Barely d) Not at all

6. How much will you use the checklist when practicing sustainable design in the future? *(Please circle)*
a) A lot b) Somewhat c) Barely d) Not at all e) Other (Specify)

7. Additional inputs in which areas do you think might help enhance the Rhizome Approach and workshop structure? *(Please circle and rank relevant options)*
a) Bamboo b) Sustainability c) Social development
d) Design e) Production f) Marketing
g) Technical h) Craft i) None j) Other (Specify)

8. You would use the checklist more if… *(Please circle all relevant and rank)*
a) It was shorter
b) It was more simply worded
c) It was better looking graphically
d) It was in digital format
e) It was better explained with a booklet to make each point clearer
f) You had more time to design
g) The factors in the checklist were made compulsory by the client

h) The factors in the checklist were made compulsory by the government
i) Most other designers started using the checklist as well
j) Other (specify)

VIEWS ON SUSTAINABILTY

9. How familiar are you with concepts relating to sustainability? *(Please circle)*
Very b) Somewhat c) Barely d) Not at all

10. How familiar are you with concepts relating to sustainable design? *(Please circle)*
Very b) Somewhat c) Barely d) Not at all

11. Which of the below do you relate to the concept of sustainability? *(Rank the options you find relevant in order of priority)*
a) Preserving the environment
b) Preserving biodiversity
c) Rural development
d) Fair Trade
e) Cleaner products
f) Craft conservation
g) Heritage conservation
h) Sustainable development
i) Recycle, renew, reuse
j) Green design
k) Ecodesign
l) Gender-friendly
m) Other (Please specify)

12. Which of these sustainability related models do you know about? *(Please circle)*
a) Ecodesign b) Triple Bottomline
c) Four Pillars model d) Five Capitals model e) None
f) Other (Please specify)

13. Which aspects do you think to be considered while designing sustainably? *(Rank the options you find relevant in order of priority)*
Ecological b) Social c) Cultural d) Economic e) Ethical
f) Political g) Other (Please specify)

14. Sustainable design should consider… *(Circle the options you find relevant and rank the Top 10 in order of priority)*
a) Cleaner material
b) Renewable material
c) Low energy-consumption
d) Biodegradable material
e) Recyclable material
f) Recycled material
g) Material that is supplied by poor/marginalized/local producers
h) Fairly traded material
i) Sustainably harvested and managed material
j) Minimally treated and processed material
k) Material which has been traditionally used by local/indigenous communities
l) Use of minimum material possible in the product
m) Less harmful/sustainable combination materials
n) Indigenous treatments and processes

o) Production which has less emissions
p) Minimum production steps
q) Use of renewable energy for production
r) Generation of less waste and efficient waste management
s) Material reduction through efficient production systems
t) Healthy and safe working environment for producers
u) Fair wages and benefits to producers
v) Non-discriminatory production system
w) Employment to marginalized producers
x) Capacity building of producers
y) Involving producers in decision-making
z) No child and forced labor
aa) Respect for human rights of producers
bb) Indigenous representation in decision-making where indigenous resources are used
cc) Minimum product weight
dd) Reduction in distribution volume/weight
ee) Minimum packaging
ff) Clean/cleaner packaging
gg) Recyclable packaging
hh) Packaging made from reused/recyclable material
ii) Energy efficient transport for distribution
jj) Localized production and distribution systems to reduce physical production to delivery cap
kk) Low energy-consumption during usage
ll) Reduction of disposable auxiliary materials through permanent product feature
mm) Efficient use of consumable during usage
nn) Use of clean consumable during usage
oo) Safe for users' health
pp) Customizable product
qq) User-friendly product
rr) Affordable product
ss) Easy to maintain and repair product
tt) Affordable product
uu) Easily upgradeable product
vv) Classic design
ww) Products which promote a strong user–product relationship
xx) Locally repairable and maintainable product
yy) Product which can easily be disassembled
zz) Product made from mono or single material
aaa) Recyclable product
bbb) Product where harmful parts are easily isolatable for separate disposable
ccc) Products which create employment of local communities through recycling
ddd) None of these
eee) Other (Please specify)

15. The aim of sustainable design is… *(Rank the options you find relevant in order of priority)*
a) To increase sales and business
b) To preserve the environment
c) To ensure fair wages to producers
d) To redistribute wealth more equitably
e) To ensure fair trade
f) To conserve culture
g) To prevent child labor
h) To provide better working conditions for labor
i) To provide fair opportunities to all

j) To reduce pollution
k) To address global warming
l) Other (Please specify)

16. Which of these aspects need to be considered while designing sustainably? *(Rank the options you find relevant in order of priority)*

a) Material selection
b) Material production and processing
c) Fabrication
d) Distribution
e) Use
f) End-of-life handling
g) Other (Please specify)

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 11: VALIDATION- PARTICIPANTS LIST

NAME	AGE	SEX	DESIGNATION	BACKGROUND
Bui Ngoc Long	43	Male	Marketing staff, working in GRET organization	Marketing staff, working in GRET organization
Tran Thi Kim Yung	22	Male	Undergraduate design student	Industrial design
Pham Anh Duc	37	Male	PhD Candidate	Environment
Nauyen Thi Tran Chau Ngoc	27	Female	Professional	Industrial design
Pham Ngoc Thu	39	Female	Postgraduate/master's design student	Industrial design
Nguyen Thi Tam Lang	37	Female	Postgraduate/Master's design student	Environment
Le thi Twing van	23	Female	Postgraduate/Master's design student	Environment
Nguyen T Le Ufn	35	Female	Not mentioned	Engineering
Miuli Trai Ta	30	Male	Professional	Industrial design
Nguyen Chanh Phuong	37	Male	Postgraduate/Master's design student	Architecture
Vu Tran Ngoc Anh	27	Female	Professional	Engineering
Doan Minh Quang	23	Female	Professional	Engineering
van Nguyen Thai Binh	36	Male	Not mentioned	Engineering
Nguyen thi Thanh Binh	42	Female	Not mentioned	Food technology, Biotechnology
Nguyen Thanh Binh	36	Female	Not mentioned	Engineering
Huong Nguyen Thi Mai	34	Female	Postgraduate/Master's design student	Industrial design
Li van Nhat Huai	32	Male	Postgraduate/Master's design student	Engineering
Nguyen Thanh Tan	42	Male	Professional	Architecture
Le Anh Vu	29	Male	Postgraduate/Master's design student	Engineering
Bui Quoc Hoai	28	Male	Professional	Craft design
Tran Thanh Tan	29	Male	Postgraduate/Master's design student	Engineering
Nguyen Thi Ngoc Anh	34	Female	Postgraduate/Master's design student	Industrial design

ANNEXURE 12: INTERNATIONAL VALIDATION: PARTICIPANTS LIST

SR. NO.	NAME	REGION	COUNTRY
1	Hong Hoang	SE Asia	Vietnam
2	Tuyen Pham	SE Asia	Vietnam
3	Loan Le	SE Asia	Vietnam
4	Sara Suib	SE Asia	Malaysia
5	Sarah Nakisanze	Africa	Uganda
6	Corbin Raymond	Africa	South Africa
7	Paulson Letsholo	Africa	Botswana
8	Richie Moalosi	Africa	Botswana
9	Gulay Hasdogan	Turkey	Turkey
10	Shauna Jin	Australia	Australia
11	Annemarie Mink	EU	Netherlands
12	Jotte de Koning	EU	Netherlands
13	Alexandra-Joy Jaeckel	EU	Germany
14	Valerie Kramis Hollands	Latin America	Mexico
15	Rafael Aguirre	Latin America	Mexico

ANNEXURE 13: INTERNATIONAL VALIDATION QUESTIONNAIRE

INDIVIDUAL QUESTIONNAIRE for Rhizome Approach
18^{th} March, 2016
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Name: E-mail address:

Overview of Rhizome Approach

STEP	BARRIER	AIM	METHOD	SUGGESTED MECHANISMS
1	Lack of knowledge about sustainability	Inform designers about sustainability, and the connections between its tenets	Didactic knowledge through knowledge kit to provide information and knowledge on the core concepts on sustainability	• Providing participants with knowledge kit in the form of background reading material • PPT presentations by experts
2	Lack of a holistic overview of the production-to-consumption system	Sensitize designers to the systemic production-to-consumption system	Experiential learning through exposure visits to different nodes of the production-to-consumption system	• Exposure visits to different nodes of the production-to-consumption system
3	Failure to include sustainability at a strategic level in the overall approach	Factor sustainability into the strategic blueprint	Internalization of sustainability at a strategic level through discussions and experiential learning	• Sharing and explaining sustainability goals or road-maps for an overall picture of what all the participants will work towards • Concept mapping exercises on relevance of craft, relevance of sustainability, systems impact of different types of products etc.
4	Failure to include sustainability criteria in the design brief	Articulate sustainability criteria in the design brief	Clear brief supplemented by the Sustainability Checklist to clarify desired design decisions and their impact on each tenet of sustainability	• Clear brief to 'design a commercially-viable product, using local production capacities, that leverages indigenous knowledge systems' Providing designers with Holistic Sustainability Checklist and manual
5	Lack of a collaborative design process	Provide inputs from different stakeholders towards a collaborative design process	Constant linkage and interaction with stakeholders of the production-to-consumption system to facilitate collaborative design	• Ice-breaking, team-building and energizing exercises • Constant feedback from experts and stakeholders

6	Lack of tools to measure holistic sustainability against indicators	Increase designers' accountability to factor sustainability into their designs and provide a tool to measure the sustainability achieved	Evaluation of design against the Holistic Sustainability Checklist by three evaluators	• Self-evaluation by designers using the Holistic Sustainability Checklist • Additional evaluation by two experts • Arriving at a single "score" using the three scores
7	Failure to keep the design team in the loop during product actualization	Keep designers in the loop until final product actualization	Involving design team in all iterations of the design, up to final product actualization	• Keeping designers in the loop through e-mail and involving them in all changes up to final prototype resolution

1. Do you feel that following the seven steps of the Rhizome Approach (listed above) would help designers to addressing sustainability in a holistic manner while working with craft-based SMEs in the developing world?

a) Yes b) No c) Not sure d) Other (Specify) _____

2. Please rate the importance of the steps in the table below in helping designers to addressing sustainability in a holistic manner, while working with craft-based SMEs in the developing world? (Please rate most important as 1, second most important as 2 and so on, up to 7)

STEP	RATING
Inform designers about sustainability, and the connections between its tenets	
Sensitize designers to the systemic production-to-consumption system	
Factor sustainability into the strategic blueprint	
Articulate sustainability criteria in the design brief	
Provide inputs from different stakeholders towards a collaborative design process	
Increase designers' accountability to factor sustainability into their designs and provide a tool to measure the sustainability achieved	
Keep designers in the loop until final product actualization	

3. Is there any additional step you think can be added to the Rhizome Approach to make it more effective?

a) Yes b) No c) Not sure

4. If yes to the question above, please write what that step would be in the space below.

STEP 1: PROVIDING KNOWLEDGE AND INFORMATION ON SUSTAINABILITY

5. Do you feel that Step 1 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?

a) Yes b) No c) Not sure d) Other (Specify) _____

6. If yes, do you think that providing designers with background reading material and presenting the core concepts of sustainability to them through PPTs is a good way of achieving this?
a) Yes b) No c) Not sure d) Other (Specify) _____

7. Do you think there are better ways to inform designers about sustainability and the connections between its tenets than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
If yes, how?

STEP 2: ENABLING A HOLISTIC OVERVIEW ON PRODUCTION-TO-CONSUMPTION SYSTEMS AND VALUE CHAINS

8 Do you feel that Step 2 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?
a) Yes b) No c) Not sure d) Other (Specify) _____

9. If yes, do you think that exposure visits to different nodes of the production-to-consumption system and value-chain is a good way of achieving this?
a) Yes b) No c) Not sure d) Other (Specify) _____

10. Do you there are better ways to sensitize designers to the systemic production-to-consumption system, than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
If yes, how?

STEP 3: INCLUDING SUSTAINABILITY AT A STRATEGIC LEVEL

11. Do you feel that Step 3 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?
a) Yes b) No c) Not sure d) Other (Specify) _____

12. If yes, do you think that internalization through sharing a common framework, and concept mapping to understand its relevance is a good way of achieving this?
a) Yes b) No c) Not sure d) Other (Specify) _____

13. Do you there are better ways to factor sustainability into the strategic blueprint than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
16. If yes, how?

STEP 4: INCLUDING SUSTAINABILITY CRITERIA IN THE DESIGN BRIEF

14. Do you feel that Step 4 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?
a) Yes b) No c) Not sure d) Other (Specify) _____

15. If yes, do you think that a clear brief supplemented by the Sustainability Checklist to clarify desired design directions and their impact on each tenet of sustainability is a good way of achieving this?
a) Yes b) No c) Not sure d) Other (Specify) _____

16. Do you there are better ways to articulate sustainability criteria in the design brief than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
If yes, how?

STEP 5: COLLABORATIVE DESIGN PROCESS

17. Do you feel that Step 5 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?
a) Yes b) No c) Not sure d) Other (Specify) _____

18. If yes to 37), do you think that ice breaking and team building exercises is a good way of achieving this?
a) Yes b) No c) Not sure d) Other (Specify) _____

19. If yes to 37), do you think that constant input from value-chain experts and stakeholders is a good way of achieving this?
a) Yes b) No c) Not sure d) Other (Specify) _____

20. Do you there are better ways to provide inputs from different stakeholders towards a collaborative design process than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
If yes, how?

STEP 6: PROVIDING TOOLS FOR SUSTAINABILITY DESIGN

21. Do you feel that Step 6 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?
a) Yes b) No c) Not sure d) Other (Specify) _____

22. If yes, do you think that evaluation of the design against the checklist by three evaluators is a good way to achieve this?
a) Yes b) No c) Not sure d) Other (Specify) _____

23. Do you there are better ways to increase designer's accountability to factor sustainability into their designs and provide a tool to measure the sustainability achieved than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
If yes, how?

STEP 7: KEEPING THE DESIGN TEAM IN THE LOOP UNTIL FINAL PRODUCT ACTUALIZATION

24. Do you feel that Step 7 (listed above) should be part of an approach towards designers addressing sustainability in a holistic manner through their designs?
a) Yes b) No c) Not sure d) Other (Specify) _____

25. If yes, do you think that involving the design team in all iterations of the design up to the final product actualization is a good way to achieve this?
a) Yes b) No c) Not sure d) Other (Specify) _____

26. Do you there are better ways to keep designers in the loop until the final product actualization than what this approach proposes?
a) Yes b) No c) Not sure d) Other (Specify) _____
If yes, how?

THANK YOU FOR YOUR TIME AND PATIENCE!

ANNEXURE 14: AGENDA FOR BRANDING WORKSHOP IN VIETNAM

Agenda for Branding Workshop
Date: 5th March, 2012

Participants:
- 15–30 participants.
- At least three producers, at least three designers, at least three from government/policy, at least three exporters, at least three marketing sector organization, at least three NGOs.
- One representative from each agency partnering under OneUN for this project.
- Media representation can be additional, if required.
- Translator

Aim:
- The interactive branding workshop will be held on the 5th March, 2012 to facilitate participatory development of the branding concept, and green assessment criteria by a cross section of stakeholders from the handicraft-sector value chain.

Workshop Structure:

Introduction

ACTIVITY	DURATION
• Rene to introduce the purpose of workshop in English	5 minutes
• Ngoc to introduce the purpose in Vietnamese	5 minutes
• International Expert with van Anh to introduce structure of workshop	5 minutes

Icebreaking

ACTIVITY	DURATION
• Three games exercise	10 minutes
• Forming group exercise	10 minutes

Brainstorming

ACTIVITY	DURATION
• There will be an interactive brainstorming using adhesive notes to be able to see the complete pictures of the expectations of the stakeholders. Each of the stakeholders will be asked to write at least five expectations on different adhesive notes and this will be compiled to understand the larger picture.	20 minutes
• There will be an interactive brainstorming using adhesive notes to map the concerns of the stakeholders in the value chain. Each of the stakeholders will be asked to write at least five expectations on adhesive notes and this will be compiled to understand the larger picture from the view point of production, marketing, design, etc.	20 minutes

Green Criteria

ACTIVITY	DURATION
• The green assessment criteria draft will be prepared by UNIDO’s International Expert. This will be presented to the stakeholders, and their feedback on it will be recorded and incorporated towards the final version.	20 minutes
• Group-wise SWOT Analysis of the proposed Green Assessment Criteria	20 minutes
• Filling in questionnaire and form on Green Assessment Criteria	20 minutes

Concluding Workshop

ACTIVITY	DURATION
• Vote of thanks to everyone who attended, by Renee	5 minutes
• Vote of thanks to everyone who attended, by Ngoc	5 minutes

ANNEXURE 15: BRANDING WORKSHOP: QUESTIONNAIRE

INDIVIDUAL QUESTIONNAIRE for branding initiative
5th March, 2012
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Name:

1. How useful was the checklist in understanding the different sustainability concerns and factors at each stage of the product life cycle? *(Please circle)*
   a) Very b) Somewhat c) Barely d) Not at all

2. How many new factors relating to sustainability as compared to those you knew of earlier did you come to know of through the checklist? *(Please circle)*
   a) A lot b) A few c) Barely any d) None

3. The checklist can be improved if… *(Please circle all relevant)*
   a) It was shorter with only headline criteria
   b) It had both headline and detailed criteria
   c) It was more simply worded
   d) It was better looking graphically
   e) It was in digital format
   f) Other (Specify)

4. How much did you like the concept of 360-degree evaluation? *(Please circle)*
   a) Very b) Somewhat c) Barely d) Not at all

5. How much did you like the concept of the visual representation in a "sustainability landscape?" *(Please circle and rank relevant options)*
   a) Very b) Somewhat c) Barely d) Not at all

6. In your own words, please tell us which part of the entire system you liked worst and least and why? *(Use space below and, if necessary, the back of this page as well)*

ANNEXURE 16: VALUE-CHAIN QUESTIONNAIRE

Full Name: Age:

Gender : Occupation:

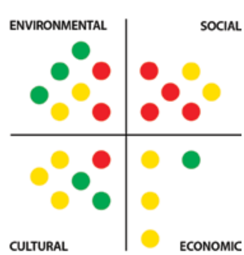
Address:

The sustainability evaluation check list for the Handicraft sector

PRODUCTION -TO- CONSUMPTION CHAIN	SUSTAINABILITY PARAMETER	ENVIRONMENTAL TENET	ECONOMIC TENET	SOCIAL TENET	CULTURAL TENET	CRAFT PROCESS
MATERIAL CONSIDERATIONS	Cleaner	•				•
	Renewable	•				•
	Low energy-consumption	•	•			•
	Biodegradable	•				•
	Recyclable	•	•			•
	Recycled	•				•
	Supplied by poor/marginalized/local producers	•	•	•		•
	Fairly traded			•		•
	Sustainably harvested and managed	•		•		•
	Minimum treatment for processing	•	•			•
	Background of local/indigenous production systems			•	•	•
PRODUCTION CONSIDERATIONS	Minimum material	•	•			•
	Less harmful/more sustainable combination materials	•		•		•
	Indigenous treatments and processes	•		•	•	•
	Less emissions	•		•		•
	Minimum production steps	•	•			•
	Renewable energy used	•	•			•
	Less waste generated/waste reused	•	•		•	•
	Material reduction through efficiency	•	•			•
	Healthy and safe working environment			•	•	•
	Fair wages and benefits to producer			•	•	•
	Non-discriminatory			•	•	•
	Employment to marginalized producers			•	•	•
	Capacity-building of producers		•	•	•	•
	Producers involved in decision-making			•	•	•
	No child and forced labor			•	•	•
	Respect for human rights of producers			•	•	•
	Indigenous representation in decision-making affecting indigenous resources			•	•	•

DISTRIBUTION CONSIDERATIONS	Minimum weight					
	Reduction in distribution volume/weight	•	•			•
	Minimum packaging		•			•
	Clean/cleaner packaging	•				•
	Reusable packaging	•	•			•
	Recyclable packaging	•				•
	Packaging made from reused/recyclable material	•			•	
	Energy-efficient transport for distribution	•				•
	Localized production and distribution systems to reduce physical production to delivery gap	•	•	•	•	•
CONSUMER-USE CONSIDERATIONS	Low energy-consumption during usage	•			•	•
	Clean energy-consumption during usage	•			•	•
	Reduction of disposable auxiliary materials through permanent product feature	•				•
	Efficient use of consumables during usage	•				•
	Use of clean consumables during usage	•				•
	Safe for users health	•		•		•
	Customizable		•		•	•
	User-friendly			•	•	•
	Affordable		•	•		•
	Easy to maintain and repair	•			•	•
	Easily upgradeable	•			•	•
	Classic design	•			•	•
	Promote a strong user–product relationship			•	•	•
	Locally repairable and maintainable	•		•		•
END-OF-LIFE HANDLING CONSIDERATIONS	Classic design and robust quality, enabling product to be passed down and reused	•		•	•	•
	Designed for disassembly	•				
	Mono-material	•		•		•
	Recyclable	•	•			
	Toxic harmful materials easily isolatable for separate disposal	•		•		
	End-of-life handling facilitate employment for local communities through recycling			•		•

This will be represented visually through color representing a "sustainability landscape." The final color and representation will be decided during the graphic brand creation. However, for the purpose of explanation, for example, red=low, orange=medium, green=high. This can be represented on a matrix as below:



INDIVIDUAL QUESTIONNAIRE
for Branding Initiative

Pl. Note: There is no correct or incorrect answer. All answers are subjective.

1. How useful was the checklist in understanding the different sustainability concerns and factors at each stage of the product life cycle? *(Please circle)*

a) Very b) Somewhat c) Barely d) Not at all

2. How many new factors relating to sustainability as compared to those you knew of earlier did you come to know of through the checklist? *(Please circle)*

a) A lot b)A few c) Barely any d)None

3. The checklist can be improved if… *(Please circle all relevant)*

a) It was shorter with only headline criteria
b) It had both headline and detailed criteria
c) It was more simply worded
d) It was better looking graphically
e) It was in digital format
f) Other (Specify)

4. How much did you like the concept of 360-degree evaluation? *(Please circle)*

a) Very b) Somewhat c) Barely d) Not at all

5. How much did you like the concept of the visual representation in a “sustainability landscape?”*(Please circle and rank relevant options)*

a) Very b) Somewhat c) Barely d) Not at all

6. In your own words, please tell us which part of the entire system you liked worst and least and why? *(Use space below and if necessary the back of this page as well)*

QUESTIONAIRE FOR EVALUATION
Of the use of the Survey Questionaire
For assessment of green brand's tenets

1. What is your opinion on the importance of sustainability (in material, environment …) in the field of handicraft? *(Please circle one choice)*
   a) Very important
   b) Important
   c) Normal
   d) Not important
   e) Don't care

2. From your point of view, how important a role would the idea of being attached the "Sustainability Brand" Value have in the process of production and sale of handicraft? *(Please circle as many option as you want)*
   a) Increase value to the products
   b) Increase the awareness of the customers
   c) Increase the competing advantage in market
   d) No role at all
   e) Different role. Specific: ……………………………………………………

3. Please sort the tenets in building a green brand in order of importance from most to least. *(Number the ranking from 1 to 5)*

1	Materials to produce the items
3	The process of production
2	The process of handling failed products (waste)
4	The process of distribution
5	The process of consumer use

4. According to your view, based on the proposed tenets, which candidate should the enforcement of Green Brand Requirement be applied on? *(Circle your various choices as you see)*
   a) Material producers (planters…)
   a) Material rough treatment processers
   b) Craftsmen
   c) Production Facility.
   d) Product distributers
   e) Consumers

5. From your own point of view, which candidate should do the building of a green brand? *(Circle your choices)*
   a) Product
   b) Products' group
   c) Producers
   d) Producers' group
   e) Entire industry

6. What are your desires about green products vis-à-vis the steps below?

TENET OF A GREEN BRAND	YOUR DESIRES
Raw material	
The process of gathering materials	
Production	
Waste handling methods	
Recycling methods	

7. Which group should possess the right to "Sustainability Brand?" *(Circle ONE choice)*
   a) Material producing regions
   b) Producers (craftsmen, laborers, handicraft villages…)
   c) Commercial organizations in sale and distribution
   d) Other group. Specific: ……………………………………………………….

8. In your own words, which additional tenets, other than the proposed ones, will be needed to ensure the building of a green brand?

***** THIS PART FOR PRODUCERS, DISTRIBUTORS, AND SALE ORGANIZATIONS**

9. What do you feel about the idea of "Sustainability Brand" being a part of "National Brand?" *(Circle one choice)*
   a) Like
   b) Dislike

10. If you are awarded a certificate of "Green Brand", what kind of ceremonies do you want to happen? *(Check X onto your choice)*

	PERIODICAL RENEW	ONE-TIME (PERMANENT)
Certificate Granted		
Stamps Granted		

*****THIS PART FOR CONSUMERS**

11. What do you feel about a product that attached with "Sustainability Brand?" *(Circle multiple choices if needed)*
   a) Choose it immediately
   b) Buy which is cheaper
   c) Depend on the circumstance
   d) Don't care if that product is attached with that brand or not

Please accept our sincerest thanks!

ANNEXURE 17: OPERATIONALIZATION OF BRANDING-GROUP QUESTIONNAIRE

GROUP QUESTIONNAIRE for
Operationalization of Branding Handicraft for Vietnam
21st November, 2012
Pl. Note: There is no correct or incorrect answer. All answers are subjective.

Group Members:

Kick-out criteria

1. Do you think that there should be 'kick-out criteria' or criteria that are absolutely essential for compliance?
a) Yes b) No

2. If yes, then please circle the criteria which should be 'kick-out criteria':

MANUFACTURING CONSIDERATION	1. Renewable
	2. Minimally/sustainably treated
	3. Recyclable
	4. Recycled
	5. Supplied locally on fair trade terms
PRODUCTION CONSIDERATIONS	6. Minimum material
	7. Minimum production steps
	8. Material reduction through efficiency
	9. Renewable energy used
	10. Less emissions
	11. Less waste generated/waste reused
	12. Indigenous treatments and processes
	13. Indigenous representation in decision-making affecting indigenous resources
	14. Healthy and safe working environment
	15. Fair wages and benefits to producer
	16. No child and forced labor
	17. Capacity-building of producers
DISTRIBUTION CONSIDERATIONS	18. Minimum distribution volume/weight
	19. Energy-efficient transport for distribution
	20. Localized production and distribution systems to reduce physical production to delivery gap
	21. Minimum packaging
	22. Reusable packaging
	23. Recyclable packaging
	24. Packaging made from reused/recyclable material

CONSUMER-USE CONSIDERATIONS	25. Low/clean energy-consumption during usage
	26. Reduced and clean consumables during usage
	27. Safe for users' health
	28. Customizable
	29. User-friendly
	30. Affordable
	31. Easily upgradeable
	32. Classic design
	33. Promote a strong user–product relationship
	34. Locally repairable and maintainable
END-OF-LIFE HANDLING CONSIDERATIONS	35. Mono-material
	36. Designed for disassembly
	37. Recyclable
	38. End-of-life handling facilitate employment for local communities through recycling

Remove criteria

3. Do you think that some criteria should be removed?
   a) Yes b) No

4. If yes, then please circle the criteria which should be removed.

MANUFACTURING CONSIDERATION	1. Renewable
	2. Minimally/sustainably treated
	3. Recyclable
	4. Recycled
	5. Supplied locally on fair-trade terms
PRODUCTION CONSIDERATIONS	6. Minimum material
	7. Minimum production steps
	8. Material reduction through efficiency
	9. Renewable energy used
	10. Less emissions
	11. Less waste generated/waste reused
	12. Indigenous treatments and processes
	13. Indigenous representation in decision-making affecting indigenous resources
	14. Healthy and safe working environment
	15. Fair wages and benefits to producer
	16. No child and forced labor
	17. Capacity-building of producers

DISTRIBUTION CONSIDERATIONS	18. Minimum distribution volume/weight
	19. Energy-efficient transport for distribution
	20. Localized production and distribution systems to reduce physical production to delivery gap
	21. Minimum packaging
	22. Reusable packaging
	23. Recyclable packaging
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	26. Reduced and clean consumables during usage
	27. Safe for users' health
	28. Customizable
	29. User-friendly
	30. Affordable
	31. Easily upgradeable
	32. Classic design
	33. Promote a strong user–product relationship
	34. Locally repairable and maintainable
END-OF-LIFE HANDLING CONSIDERATIONS	35. Mono-material
	36. Designed for disassembly
	37. Recyclable
	38. End-of-life handling facilitate employment for local communities through recycling

Club criteria

5. Do you think that some criteria should be clubbed together?
   a) Yes b) No

6. If yes, then please circle the criteria which should be clubbed together.

MANUFACTURING CONSIDERATION	1. Renewable
	2. Minimally/sustainably treated
	3. Recyclable
	4. Recycled
	5. Supplied locally on fair trade terms

PRODUCTION CONSIDERATIONS	6. Minimum material
	7. Minimum production steps
	8. Material reduction through efficiency
	9. Renewable energy used
	10. Less emissions
	11. Less waste generated/waste reused
	12. Indigenous treatments and processes
	13. Indigenous representation in decision-making affecting indigenous resources
	14. Healthy and safe working environment
	15. Fair wages and benefits to producer
	16. No child and forced labor
	17. Capacity-building of producers
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	26. Reduced and clean consumables during usage
	27. Safe for users' health
	28. Customizable
	29. User-friendly
	30. Affordable
	31. Easily upgradeable
	32. Classic design
	33. Promote a strong user–product relationship
	34. Locally repairable and maintainable
END-OF-LIFE HANDLING CONSIDERATIONS	35. Mono-material
	36. Designed for disassembly
	37. Recyclable
	38. End-of-life handling facilitate employment for local communities through recycling

7. Which set of headline criteria do you prefer?

   a) 1) Environment 2) Human rights 3) Labor practices 4) Fair operating procedures 5) Consumer issues 6) Community involvement

   b) 1) Cleaner 2) Livelihood generation 3) Fair trade 4) Efficient 5) User-friendly 6) Maximized product life 7) Closed loop

   c) You can also make up your own set of criteria in the space below:

SAMENVATTING

Hernieuwbare materialen—zoals bamboe, kurk en hennep—die overvloedig aanwezig zijn in ontwikkelingslanden, hebben het potentieel om een levensvatbare en duurzame hulpbron te zijn voor duurzame ontwikkeling; vooral gezien het feit dat opkomende mondiale markten zich steeds meer richten op duurzaamheid. Huidige duurzaam ontwerp-initiatieven en -methoden kijken al naar het gebruik van industriële technieken en technologieën om deze materialen in een nieuwe context te plaatsen. Daarmee wil men innovatieve producten en systemen creëren voor eigentijdse op duurzaamheid georiënteerde markten. Hoewel de resulterende ontwerpen voortkomend uit deze initiatieven inderdaad meer dan te doen gebruikelijk oog hebben voor ecologische duurzaamheid en duurzaamheidsmarkten, profiteren zij niet van de enorme menskracht en culturele hulpbronnen die beschikbaar zijn in ontwikkelingslanden. Daarom gaan deze producten vaak voorbij aan de behoeften en kansen voor ontwerpen die het toonbeeld zouden kunnen zijn van “holistische duurzaamheid”: ontwerpen waarin verder wordt gegaan dan de focus op ecologie, door ook rekening te houden met de sociale, culturele en economische aspecten van duurzaamheid.

Veel van de genoemde hernieuwbare materialen groeien overvloedig in ontwikkelingslanden, waar zij van oudsher deel uitmaken van ambachtelijke productie-consumptie-systemen. De toevloed van industriële producten van elders naar ontwikkelingslanden, waar hernieuwbare materialen traditioneel deel zijn van de plaatselijke ambachtelijke systemen, heeft geleid tot een verlies van afzetmarkten voor betrokken ambachtslieden. Zodoende zijn zij steeds kwetsbaarder geworden voor eco-sociaal-economisch-culturele onduurzaamheden, waaronder een in kwaliteit afnemende leefomgeving, werkloosheid, armoede en het verlies van identiteit door noodgedwongen migratie. Als design zou bouwen op de originele ambachtelijke productie-consumptie systemen—in plaats van deze te omzeilen door een op de massa gerichte, industriële technologie-push-aanpak te kiezen—zou het verder kunnen gaan dan het maken van mainstream producten, door het orkestreren van productie-consumptie systemen die holistisch duurzaam van aard zijn. De resulterende producten zouden dan kunnen worden geproduceerd met hernieuwbare (ecologisch duurzame) materialen, vervaardigd op een arbeidsintensieve (maatschappelijk duurzame) wijze, gebaseerd op (cultureel duurzame) ambachtelijke tradities en inheemse kennis en gericht op levensvatbare (economische duurzame) markten van de economie. Dit zou kunnen bijdragen aan holistische duurzaamheid, door het gelijktijdig aanpakken van de complexe en verweven sociale, culturele en economische onduurzaamheden, zoals armoede en werkloosheid, in ontwikkelingslanden.

Het verwezenlijken van dit potentieel vraagt om alternatieven voor de huidige mainstream technologie-intensieve industriële ontwerpbenaderingen die het begrip duurzaamheid niet op een holistische manier benaderen. Idealiter kunnen deze holistische alternatieven collectieve voordelen genereren voor het milieu, de maatschappij, de economie en de cultuur in ontwikkelingslanden. Het doel van dit onderzoek is daarom bestaande duurzame ontwerpbenaderingen in holistische zin te verbeteren, en daarmee ook hun praktijk, vooral binnen het domein van het midden- en klein-bedrijf (MKB) in ontwikkelingslanden werkend met hernieuwbare grondstoffen.

De specifieke onderzoeksvragen zijn:
ONDERZOEKSVRAAG 1:
In hoeverre kan design duurzaamheid op een holistisch wijze benaderen- tegelijk rekening houdend met al haar facetten, waaronder sociale, economische, ecologische en culturele- in het geval dat design toegepast wordt bij niet-industriële ambachtelijke MKB-bedrijven in ontwikkelingslanden die werken met hernieuwbare materialen?

ONDERZOEKSVRAAG 2:
Wat kan een mogelijke duurzame-ontwerpbenadering zijn die a) rekening houdt met de voor- en nadelen van bestaande duurzaamheid-ontwerpbenaderingen, en b) een holistisch beeld geeft van duurzaamheid, inclusief de ecologische, sociale, economische en culturele dimensies in relatie tot niet-industriële ambachtelijke MKB-bedrijven die werken met hernieuwbare materialen in ontwikkelingslanden?

ONDERZOEKSVRAAG 3:
Welke mechanismen zouden het gebruik en de operationalisering van een duurzaamheid-ontwerpbenadering die ontwikkeld zou kunnen worden in antwoord op Onderzoeksvraag 2 kunnen ondersteunen en aanmoedigen?

Elk hoofdstuk van dit proefschrift heeft betrekking op dit brede onderwerp conform de blauwdruk van de onderzoeksopzet zoals beschreven in hoofdstuk 2. We hebben voor ‘design science research’ als onderzoekmethodologie gekozen omdat deze het beste het brede veld van innovatie en duurzaamheid als een “wicked,” multidimensionaal en dynamisch probleem benadert. Design science research ontwikkelt en test oplossingen in een specifieke real-world context die een probleem van een grotere orde representeert. Vervolgens worden deze specifieke oplossingen iteratief verbeterd zodat ze toepasselijk zijn op de grotere, algemene probleem-klasse. Dit komt overeen met ons streven naar het verbeteren van bestaande duurzaamheid-ontwerpbenaderingen, en daarmee de praktijk bij MKB-bedrijven die werken met hernieuwbare materialen in ontwikkelingslanden via praktijkgericht onderzoek. De globale fasen van dit design science onderzoek omvatten: **1) uitwerken van de probleemstelling 2) presentatie van achtergrondinformatie, 3) definitie van de doelstellingen van een oplossing, 4) ontwerp en ontwikkeling, 5) demonstratie 6) verfijning van het definitieve ontwerp en 7) evaluatie van het definitieve ontwerp.** Terwijl dit proefschrift deze stadia voor de helderheid in chronologische volgorde presenteert, waren de diverse onderzoek- en ontwerp-fasen in de praktijk merendeels cyclisch van aard en nauw verweven met de praktijk.

De eerste stap in dit onderzoek - de verwoording van Onderzoeksvraag 1 - was belangrijk om de eventuele vooronderstelling dat huidige duurzaamheid ontwerpbenaderingen duurzaamheid al op een holistische wijze adresseren te elimineren – om op deze wijze een objectieve verkenning mogelijk te maken. Dit is gedaan via een brede literatuurstudie, sinds het domein gedefinieerd door de onderzoeksvragen nog in wording en onontgonnen is. Het literatuur onderzoek heeft niet geleid tot enkelvoudige, alom geaccepteerde definities van de kernbegrippen binnen dit onderzoek, zoals betreffende duurzaamheid, ontwikkeling, ambacht en design. Daarom gebruiken we de bevindingen uit de literatuurstudie om werkdefinities te ontwikkelen, die dienen als referentiepunten voor het onderzoek.

Het merendeel van de bekeken literatuur is gericht op individuele elementen of sub thema's van Onderzoeksvraag 1. Derhalve is het antwoord op Onderzoeksvraag 1 verkregen door de vraag te plaatsen in het kader van verschillende sub-domeinen -vis-à-vis ontwerpbenaderingen en beoordelingssystemen, vis-à-vis de ontwerppraktijk in het algemeen, en ten opzichte van ontwerppraktijk op het gebied van niet-industriële ambachtelijke MKB-bedrijven in ontwikkelingslanden die werken met hernieuwbare materialen.

Vervolgens zijn bestaande benaderingen en beoordelingsmethoden bestudeerd, die de duurzame ontwerp praktijk onderbouwen, met betrekking tot hoe holistisch zij duurzaamheid benaderen (Hfst. 3). Het referentiepunt voor holistische duurzaamheid dat hier is gehanteerd (Hfst. 2.), beschrijft dat meerdere dimensies, inclusief ecologische, culturele, sociale en economische moeten worden overwogen om duurzaamheid holistisch te adresseren. Bij de vergelijkende analyse van de bestaande aanpakken en beoordelingsmethoden ten opzichte van deze vier dimensies bleek dat geen daarvan duurzaamheid holistisch benadert (Hfst. 3). Ze zijn allemaal gericht op het economische aspect alsook eco-centrisch. De enige uitzondering hierop is een enkele categorie, Base of the Pyramid (BoP), die de sociale dimensie prioritiseert . Deze bevinding beantwoordt Onderzoeksvraag 1 vis-à-vis ontwerpbenaderingen en beoordelingssystemen. Bij het daarop volgende onderzoek naar de mate waarin ontwerpers de duurzaamheids-benaderingen en -evaluaties toepassen, bleek dat de belangstelling voor duurzaamheid en duurzaam ontwerpen niet wordt omgezet in een gemeenschappelijke praktijk van ontwerpers in ontwikkelde en ontwikkelingslanden. Dit beantwoordt Onderzoeksvraag 1 vis-à-vis de ontwerppraktijk.

Literatuuronderzoek naar ambachtelijke design interacties in de context van ontwikkelingslanden is uitgevoerd (Hfst. 4) om in te zoomen op het specifieke domein van Onderzoeksvraag 1: niet-industriële ambachtelijke MKB-bedrijven die werken met hernieuwbare grondstoffen uit ontwikkelingslanden. Het literatuuroverzicht bracht een aantal voorbeelden van top-down "designer-led" benaderingen in de ambachtelijke sector naar voren, die kunnen bijdragen aan de sociale doelstelling van duurzaamheid, zoals de duurzaamheid van ambachtelijke gemeenschappen in termen van hun inkomen of sociale status. Sommige van de hiermee samenhangende interacties worden bekritiseerd vanwege het vernietigen van het culturele erfgoed van gemeenschappen, alsook een gebrek aandacht voor de ecologische dimensie. Enkele bemoedigende voorbeelden, waar ontwerpers ambachtelijk erfgoed vertaalden in ecologische inkomsten genererende activiteiten- en die daarmee ook een positief effect op maatschappelijke, culturele en economische duurzaamheid realiseerden- zijn ook vastgesteld. Dit beantwoordt onderzoeksvraag 1 vis-à-vis de ontwerppraktijk op het gebied van niet-industriële ambachtelijke MKB-bedrijven die werken met hernieuwbare grondstoffen uit ontwikkelingslanden.

Al deze bijdragen, waaronder duurzaamheid-ontwerpbenaderingen en beoordelingssystemen, praktijk en ambachtelijk design interacties in de context van ontwikkelingslanden geven tezamen het antwoord op Onderzoeksvraag 1: Design adresseert momenteel duurzaamheid niet holistisch binnen het kader van niet-industriële ambachtelijke MKB-bedrijven in ontwikkelingslanden die werken met hernieuwbare materialen. Bestaande duurzaamheid-design praktijken richten zich in het algemeen op de ecologische en economische dimensie. Bemoedigend is echter dat het erop lijkt dat momenteel het werkterrein steeds meer wordt uitgebreid tot sociale en culturele dimensies. In het geval van ambachtelijke MKB-bedrijven, lijkt de design focus en impact te liggen op de economische dimensie. Hoewel sociale en culturele prioriteiten worden genoemd, kan worden getwijfeld aan de mate waarin die worden bereikt en de daarvoor beschikbare middelen. Binnen de bestaande ontwerppraktijk zijn geen voorbeelden gevonden waarin design, ambacht en duurzaamheid succesvol worden ingezet voor holistische duurzaamheid. Wel benadrukken opkomende kennis en discussie steeds meer het potentieel van duurzaam ontwerpen en de mogelijkheid om de ambachten als een methodologisch duurzaam innovatie-kader te positioneren. Echter, dit potentieel moet nog gerealiseerd worden en de voorgestelde middelen daarvoor zijn vooralsnog beperkt.

De bevindingen inzake Onderzoeksvraag 1 zijn weergegeven in een conceptueel kader (Hfst. 5) dat een schematisch inzicht biedt in de probleem context en het antwoord op Onderzoeksvraag 1. Zoals eerder aangegeven, is de literatuur review grotendeels gericht op enkele onderdelen of subsystemen die deel uitmaken van het conceptueel kader. Deze elementen naast elkaar hebben geleid tot een nader inzicht in de complexiteit van het duurzaamheid-ontwerpsysteem, vooral met betrekking tot ambachtelijke MKB-bedrijven in ontwikkelingslanden. Het conceptuele kader is geconstrueerd ter illustratie van deze complexiteit en tegelijkertijd zijn de voornaamste bestandsdelen, inclusief de bestaande en voorlopig voorgesteld actoren, causale ketens en richtingen weergegeven. Gezien het feit dat het literatuuronderzoek niet duidelijk succesvolle aanpakken of methodes voor holistisch duurzaam ontwerpen aangeeft, stelt het conceptuele kader ook een mogelijke richting voor het ontwikkelen en testen van een dergelijke benadering voor via verder empirisch onderzoek, daarmee leidend tot Onderzoeksvraag 2.

Dit verdere onderzoek naar een mogelijke duurzaamheid-ontwerpbenadering richt zich op de vraag waarom design momenteel duurzaamheid niet op een holistische manier adresseert. Een diepgaander literatuurstudie onthult terugkerende thema's over de barrières voor duurzaam ontwerpen in de praktijk (Hfst. 3). Deze zijn: **1) een gebrek aan kennis over duurzaamheid, 2) een gebrek aan een holistisch overzicht over productie-consumptie systemen en waardenketens, 3) het falen om duurzaamheid op strategisch niveau op te nemen in de ontwerpbenadering, 4) het niet opnemen van duurzaamheidscriteria in de ontwerpopdracht, 5) het ontbreken van een gemeenschappelijk ontwerp proces, 6) een gebrek aan hulpmiddelen, en 7) het niet aan boord houden van het ontwerpteam bij de productrealisatie.**

Om antwoord te geven op Onderzoeksvraag 2 aan de hand van deze in de literatuur gevonden factoren, zijn vier concepten ontwikkeld gedurende de eerste fase van een twee-fasen iteratief ontwerp- en ontwikkelingsproces. De eerste is een construct genaamd het Rhyzome Framework, dat mogelijke richtingen voorstelt voor de evolutie van traditionele ambachten in een ontwikkelingslandscenario, door middel van design inputs. De tweede is een methodologie die toewerkt naar design-ambacht samenwerkingen, genaamd de Rhyzome Approach, en is gericht op de facilitering van ontwerpers om ambachtelijke productie-tot-consumptie-systemen in ontwikkelingslanden beter te exploiteren voor duurzaam ontwerpen, inclusief het aangeven van richtingen binnen de Rhyzome Framework. Het derde concept, de Duurzaamheid Checklist, voorziet een levenscyclusbenadering voor de op vier pilaren gebaseerde duurzaamheidsaanpak, leidend tot een duidelijker omschrijving van de gewenste criteria binnen het model en hun impact per duurzaamheidsprincipe. Het vierde en laatste concept van deze fase van het empirisch onderzoek is het ontwerp van een demonstratie in de vorm van een workshop, welke de Rhyzome Approach en al zijn onderdelen kan demonstreren en uitproberen voor diverse probleemklassen.

De Kotwalia gemeenschap - een traditionele bamboe-arbeidsgemeenschap in Gujarat in India - is geselecteerd om de probleem klasse te representeren (Hfst. 7). Een multi-institutional Space-Making bamboe ambachtelijke Workshop (Hfst. 10) is in 2011 uitgevoerd, om de Rhyzome concepten van de eerste ontwerp- en ontwikkelingsfasen van dit design science research project te demonstreren en te testen. Aan de workshop hebben 24 ontwerpers en 24 ambachtslieden deelgenomen, conform de uitgangspunten van het Rhyzome Framework en de Rhyzome Approach waarin de nadruk ligt op gemeenschappelijke ontwerp-ambachts- inputs ten behoeve van duurzaam ontwerpen. Tijdens de workshop zijn op verschillende wijzen empirische gegevens verzameld.

Eén van de belangrijkste uitkomsten van het empirisch onderzoek is de positieve feedback en interesse met betrekking tot de Sustainability Checklist die tijdens de workshop is gebruikt. Daarbij is ook een validatietest uitgevoerd naar de overdraagbaarheid van de bevindingen, om te controleren of de uitkomsten van de workshop in India ook van toepassing zouden kunnen zijn in andere soortgelijke MKB-bedrijven omstandigheden in ontwikkelingslanden, alsook met andere materialen dan bamboe. Tevens is het de intentie geweest om ook gebruik te maken van de data-verzameling van deze fase voor de verbetering de Rhyzome Approach en de onderdelen daarvan. Wij beoordelen de overdraagbaarheid door 'face validity' studies in twee verschillende situaties betreffende onze probleem context.

1 VIETNAM: De eerste fase is uitgevoerd door het afnemen van twee vragenlijsten onder een groep Vietnamese trainers met een achtergrond in duurzame producten. De intentie was om na te gaan of de globaal response op de Rhyzome Apporach - en vooral de positieve reacties op de Sustainability Checklist en feedback voor verbetering ervan - vergelijkbaar was in India en Vietnam.

2 WERELD: De tweede fase is uitgevoerd door het afnemen van een vragenlijst per e-mail onder 15 ontwerpers in Afrika, Australië, Europa, Latijns-Amerika, Turkije en Zuid Oost Azië. De vragenlijst exploreerde de opinie van de respondenten over de Rhyzome Approach en heeft hen met de vraag geconfronteerd of zij complementaire, aanvullende of alternatieve maatregelen konden suggereren die de Rhyzome Approach effectiever zou kunnen maken.

Gebaseerd op de validatie van de bevindingen van het onderzoek en ook de feedback over de overdraagbaarheid en de verwachte doeltreffendheid van de Rhyzome Approach van de fase in Vietnam hebben we geconcludeerd dat we met succes Onderzoeksvraag 2 hebben beantwoord: de Rhyzome Approach is een mogelijke duurzaam ontwerpaanpak die het bewustzijn van de voor- en nadelen van bestaande duurzaam ontwerpen aanpakken vergroot, en die een holistisch beeld van duurzaamheid introduceert ten behoeve van niet-industriële ambachtelijke MKB-bedrijven die werken met hernieuwbare materialen in ontwikkelingslanden. Deze conclusie wordt ondersteund door de bevindingen van de vragenlijst, afgenomen onder 15 ontwerpers wereldwijd.

De volgende stap in dit PhD-thesis onderzoek betreft het beantwoorden van de laatste onderzoeksvraag: Welke mechanismen zouden het gebruik en de operationalisering van een duurzaamheid-ontwerpbenadering die ontwikkeld zou kunnen worden in antwoord op Onderzoeksvraag 2 kunnen ondersteunen en aanmoedigen?

Net zoals de meeste benaderingen en instrumenten die duurzaamheid op een meer of minder holistische wijze adresseren, waaronder tools als LCA, vuistregels en checklists, heeft de Rhyzome Approach als doel om duurzaamheidsaspecten in het ontwerp- en ontwikkelingsproces te integreren. Ons onderzoek naar de vraag waarom de belangstelling voor duurzaamheid en duurzaam ontwerp niet wordt vertaald naar een dagelijks gebruik in de ontwerppraktijk identificeerde zeven meta-barrières - slechts één daarvan was het gebrek aan hulpmiddelen: het feit dat er duurzame ontwerpbenaderingen zijn, zoals de Rhyzome Approach, betekent niet automatisch dat duurzaamheidsfactoren worden geïntegreerd in het productontwikkelingsproces. Recente literatuur over duurzaam ontwerpen benadrukt het belang van 'zachtere' aspecten - inclusief organisatorische structuren en systemen en het opbouwen van deskundigheid- die niet rechtstreeks verband houden met de productontwikkeling en ontwerpwerkzaamheden, maar de implementatie en het gebruik van duurzaam ontwerpen tools bevorderen. Onderzoeksvraag 3 richt zich om die reden op mechanismen die het gebruik en operationalisering van de Rhyzome benadering en haar onderdelen kunnen ondersteunen en bevorderen.

Onderzoeksvraag 3 wordt in hoofdstuk 12 behandeld, waarin we eerst de directe omgeving waarbinnen de ontwerper werkt - het bedrijf – bestudeerd hebben in enerzijds aspecten van het duurzaamheidstraject en de duurzaamheid drivers en anderzijds de mechanismen die invloed kunnen uitoefenen op deze drivers. Onze literatuurstudie onthulde vier fundamentele instrumenten-**1), harde wetgeving, 2) zachte wetgeving, 3) economische instrumenten en 4) communicatie-instrumenten.** De sleutelelementen voor regelgevende instrumenten om te kunnen functioneren - inclusief nauwgezette controle en handhaving, een werkend rechtssysteem en transparantie – ontbreken grotendeels in ontwikkelingslanden. De driver voor MKB-bedrijven in opkomende landen in onze probleem klasse om te investeren in duurzaam ontwerpen is daarom over het algemeen niet bestaande wetgeving of financiële prikkels, maar de markt. De dienovereenkomstige instrumenten, die het gebruik en operationalisering van de Rhyzome-Approach kunnen ondersteunen en aanmoedigen, zijn communicatieve- en zachte wetgevingsinstrumenten.

Verschillende soorten zachte- en communicatieve instrumenten zijn onderzocht, met name de talrijke vormen van zelfregulerende instrumenten die zijn ontstaan tijdens het afgelopen decennium gericht op milieubescherming. Labeling is daaruit geselecteerd, omdat het een derde generatie regelgevend instrument is waarvan de drie basisstappen zijn: **1) bepalen van de standaard, 2) certificering, en 3) communiceren van de uitkomsten van de evaluatie.** Labeling kan hierdoor de categorieën van communicatieve en zachte instrumenten overbruggen en combineren, en ook kan het besturings- en zachte vrijwillige zelfregulering overbruggen afhankelijk van hoe strikt deze ten uitvoer worden gelegd. Bovendien -in tegenstelling tot op technologie gebaseerde mechanismen, welke gericht zijn op het productiestadium en het specificeren van processen of technologieën die gebruikt moeten worden, en op prestaties gebaseerde mechanismen welke zich richten op de output fase door het specificeren van de resultaten waaraan moet worden voldaan - is labeling een op management gebaseerd mechanisme dat gericht is op de planningsfase, hetgeen in overeenstemming is met onze stelling voor front-end innovatie welke grotere duurzaamheidsdoelstellingen mogelijk maakt.

Vervolgens is geprobeerd om bestaande duurzaamheid labeling-schema's in de ambachtelijke sector te identificeren, die een bijdrage kunnen leveren aan het antwoord op onderzoeksvraag 3. Echter, de onderzochte regelingen definiëren duurzaamheid niet op een holistische wijze en vallen daarmee af. Er is daarom besloten tot het ontwikkelen van een dergelijk mechanisme via empirisch onderzoek. UNIDO's branding initiative in Vietnam is geselecteerd als het platform voor dit empirisch onderzoek. Het initiatief is op zoek naar een manier om de MKB-bedrijven, die het ondersteunt op het gebied van duurzaamheid op het spoor te houden van duurzaamheid, door het toevoegen van waarde aan en het maken van differentiatie van hun producten door middel van branding. De geschiktheid van het gebruik van de Sustainability Checklist voor dit initiatief is vastgesteld op een participatieve wijze, waarbij een aantal van de tools die waren ontwikkeld ter facilitering van de Rhyzome Approach nu zijn toegepast ter bevordering van de deelname door de belanghebbenden. De feedback van deze deelnemers is via een vragenlijst tijdens een workshop verzameld. Daarnaast is feedback verkregen van een tweede groep bestaande uit de verschillende knooppunten-actoren van de waardeketen over hetzelfde onderwerp. Aan de hand van deze feedback zijn de Sustainability Checklist en Assessment verder verfijnd. Tevens is een tweede iteratie bij een groep van belanghebbenden uit de Vietnamese ambachtelijke sector uitgevoerd en zijn dezelfde kwalitatieve gegevens verzameld.

Hierop aansluitend is –in antwoord op Onderzoekvraag 3- de definitieve versie van het ontwerp gepresenteerd, het zogenaamde Holistic Sustainability System, dat zou moeten functioneren als een mechanisme ter ondersteuning en stimulering van het gebruik en de operationalisering van de Rhyzome Approach en haar onderdelen. Verschillende opties zijn ontworpen voor de grafische voorstelling van het label en de Holististic Sustainability Checklist. Zij zijn geëvalueerd door middel van gesprekken met belanghebbenden in Vietnam, en ook door het afnemen van interviews bij de UNIDO-stand bij LifeStyle Vietnam, de internationale handwerkbeurs.

Het Holistic Sustainabilty System dat is ontwikkeld voor UNIDO's branding en labeling initiatief exploiteert de extra tijd en kosten van een investering in een holistisch-duurzaam georiënteerd ontwerpproces door middel van toegevoegde waarde en product-differentiatie. De outputs van de Holistic Sustainability Checklist werden gekwantificeerd en gecommuniceerd, en zodoende de duurzaamheidsactiviteiten gelegitimeerd als credentials. Beide tools demonstreerden dat in dit geval de investeringen in duurzaamheid loont voor bedrijven, en zodoende een "pull" is voor ontwerpers om duurzaamheid holistisch te praktiseren door middel van de Rhyzome Approach. Hiermee is Onderzoeksvraag 3 beantwoord.

Tenslotte worden de conclusies en aanbevelingen van dit proefschrift gepresenteerd (Hfst. 13), gericht op reflectie en de integratie van diverse onderdelen die in de voorgaande hoofdstukken zijn behandeld. Het onderzoek - dat meerdere diverse en discrete variabelen, inclusief ambacht, duurzaamheid, ontwerpen en ontwikkelingslanden omvat – heeft als doel om verder te gaan dan inzicht te verkrijgen in duurzaam ontwerpen voor en door de ambachtelijke sectoren in Vietnam en India en de bamboe ambachtssector in het bijzonder.

Meerdere personen en instellingen buiten dit empirisch onderzoek hebben belangstelling getoond voor de resultaten ervan. De onderzoekster verwacht dat de onderzoeksresultaten, bevindingen en in het bijzonder de Rhyzome design tools, ook flexibel toepasbaar zullen zijn in een ruimere duurzaam ontwerpen context, om zo te komen tot een verdere bijdrage aan een holistische duurzame ontwikkeling.

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CURRICULUM VITAE

Rebecca Reubens was born on the 18th of March, 1978, in Ahmedabad. She earned an undergraduate diploma in Accessory Design at the National Institute of Fashion Technology (NIFT) in India (1995–1998). She began working at the intersection of design, craft and sustainability using bamboo as the vehicle, as a Master's degree student of the National Institute of Design (NID) in India (1998–2002).

Her association with the International Network for Bamboo and Rattan (INBAR) kept her close to her subject over the next seven years, during which time she worked with bamboo craft communities in Asia, Africa and Latin America, providing support to help them re-contextualize their craft and access contemporary markets.

Rebecca left INBAR in 2009 to pursue her PhD externally at the Delft University of Technology, on the linkages between sustainability, design and development. She simultaneously set up Rhizome, her sustainability design firm, in Ahmedabad.

A large part of her work has been in the development sector, with institutions, governments, NGOs, MSMEs and communities in Europe, Asia and Africa. Recently, her work has included mainstreaming sustainability, including through Rhizome's work for Indian conglomerates such as the Godrej group.

She is passionate about working hands-on with MSMEs, to collaboratively design products that reflect the social and cultural aspects of sustainability alongside the ecological and economic ones. She believes that design can make sustainability desirable and commercially viable, and that renewable materials processed by craft producers are among the viable routes to holistic sustainability.

Rebecca remains connected to academia by teaching at design institutions in India. She has guided and mentored master's students from Asia and Europe. Her publications include the book, *Bamboo: From Green Design to Sustainable Design*.

DELFT UNIVERSITY OF TECHNOLOGY DESIGN FOR SUSTAINABILITY PROGRAM

Current sustainable design initiatives and approaches are already looking at using industrial techniques and technologies to recontextualize renewable materials to create innovative products and systems to suit global markets. However, the design outputs from these initiatives—while being mindful of ecological sustainability and targeting sustainability markets—do not leverage the huge workforce and cultural resources available in developing countries, where these materials occur abundantly and form part of traditional craft practice. These products, therefore, disregard the need and opportunity for design to also consider the social, cultural and economic dimensions of sustainability—and thus serve as a vehicle for holistic sustainability.

This is a missed opportunity to holistically impact sustainability—and sustainable development—especially since craftspeople in the developing world are increasingly vulnerable to unsustainabilities caused by a loss of markets resulting from the influx of industrial products.

If design were to build upon traditional developing-world craft production-to-consumption systems, rather than bypass them in favor of a mainstream, industrialized technology-push approach, the resultant products would be built on culturally sustainable traditions, using ecologically sustainable materials, crafted in a labor-intensive manner, and target viable sustainability-aligned markets; thus orchestrating holistically sustainable production-to-consumption systems.

Actualizing this potential calls for alternative design approaches that can generate collective benefits to the ecology, society, economy and culture in developing countries. This research, therefore, aims to improve sustainability design approaches, and thereby practice, especially in the domain of MSMEs working with renewable materials in developing countries.

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