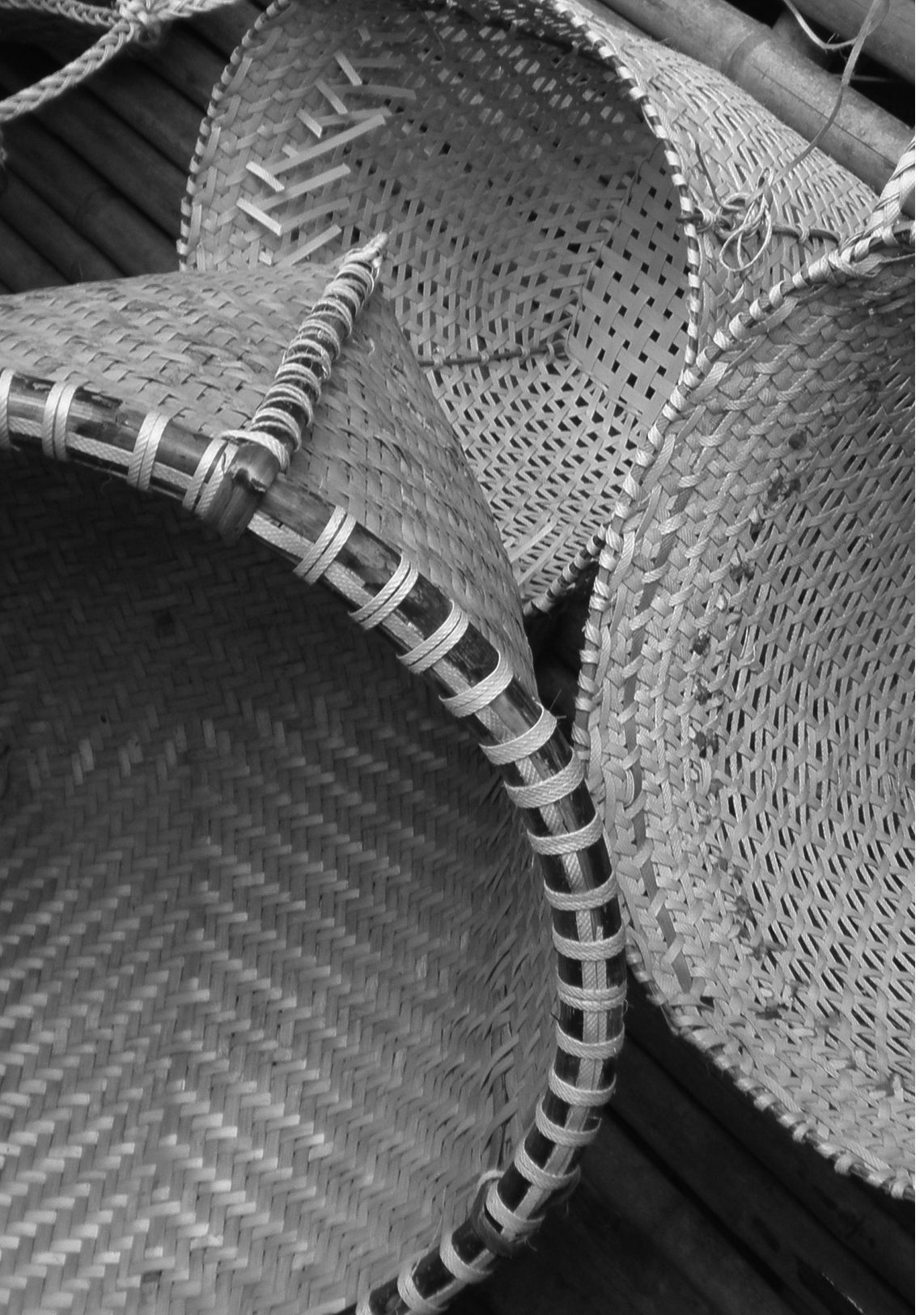

SUMMARY

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 worked 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 12 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.