

Reworking on the Cow Dung Waste Concern into Design, The Case of Cattle Farmers' Village in West Java

Amira Rahardiani¹, Adhi Nugraha², Prananda Luffiansyah Malasan³, Raditya Ardianto Taepoer⁴

Page | 126

Pusat Penelitian Produk Budaya dan Lingkungan (PPPBL) Institut Teknologi Bandung
amirahardiani@gmail.com, adhinugrahadesign@gmail.com, pranandaluffiansyah@gmail.com, radityaardianto@gmail.com

ABSTRACT

Globally, environmental pollution stemming from livestock waste remains a widespread and unresolved concern. The contamination resulting from such waste can have adverse effects on both air and water quality, impacting not only livestock owners but also neighboring non-farming communities. This paper focuses specifically on the case study of cow dung waste accumulation in the local ditches of a Cattle Farmers' village in West Java called Bukatanah Village to discuss socio-environmental concerns. Our ongoing research closely aligns with exploring the potential of residents in Bukatanah Village to address the environmental issues prevalent in their living areas. Moreover, this paper is dedicated to illustrating the significance of co-designing the concept in collaboration with the local community rather than imposing a top-down approach in the village. The process is shaped by a series of design ethnography observations, participatory design workshops, material exploration, and project evaluation stages. This paper illustrates a rethinking of solving environmental problems by engaging the locals in "design-making" activities. As a method, the concept of participatory design conducted by the PP-PBL ITB team becomes crucial to be implemented for gaining mutual ideas together with the locals. The research-initiated collaborative system empowers Bukatanah Village residents, fostering creativity and creating home-based business opportunities. This is a continued focus in multidisciplinary community development research, encompassing participatory design and ethnography methods in the process.

Keywords: Cow Dung Waste, Material Innovations; Environmental Design; Community Development; West Java

ABSTRAK

Secara global, polusi lingkungan yang berasal dari limbah ternak tetap menjadi masalah yang luas dan belum terpecahkan. Kontaminasi yang timbul dari limbah tersebut dapat memiliki dampak buruk pada kualitas udara dan air, memengaruhi tidak hanya pemilik ternak tetapi juga masyarakat non-pertanian di sekitarnya. Makalah ini secara khusus berfokus pada studi kasus akumulasi limbah kotoran sapi di saluran air lokal sebuah desa peternakan sapi di Jawa Barat yang disebut Desa Bukatanah untuk membahas masalah sosio-lingkungan. Penelitian kami yang sedang berlangsung erat kaitannya dengan mengeksplorasi potensi penduduk Desa Bukatanah untuk mengatasi isu lingkungan yang ada di tempat tinggal mereka. Selain itu, makalah ini ditujukan untuk mengilustrasikan pentingnya merancang konsep secara bersama-sama dengan komunitas lokal daripada memberlakukan pendekatan dari atas ke bawah di desa tersebut. Proses ini dibentuk oleh serangkaian pengamatan etnografi desain, lokakarya desain partisipatif, eksplorasi material, dan tahap evaluasi proyek.

Makalah ini menggambarkan sebuah pemikiran ulang untuk menyelesaikan masalah lingkungan dengan melibatkan warga setempat dalam kegiatan "pembuatan desain". Sebagai metode, konsep desain partisipatif yang dilakukan oleh tim PP-PBL ITB menjadi sangat penting untuk diimplementasikan guna mendapatkan ide bersama dengan warga setempat. Sistem kolaboratif yang diinisiasi penelitian memberdayakan penduduk Desa Bukatanah, mendorong kreativitas, dan menciptakan peluang bisnis berbasis rumah. Ini merupakan fokus berkelanjutan dalam penelitian pengembangan masyarakat multidisiplin, yang mencakup metode desain partisipatif dan etnografi dalam prosesnya.

Kata Kunci: Kotoran Sapi, Inovasi Material; Desain Lingkungan; Pengembangan Komunitas; Jawa Barat

INTRODUCTION

Local Stakeholder Movement

Having an awareness of the escalating socio-environmental issues within the cattle farming community, significant efforts have been undertaken, as evidenced by the local cooperative for dairy products (KPSBU) in Lembang. On one hand, KPSBU has established a pilot farm in the Ciater region of West Java, with the intention of creating a model cattle farming system for the area. This establishment, known as the integrated Dairy Village Ciater, demonstrates an efficient livestock management and processing system that integrates suitable technology to address waste disposal concerns. On the other hand, the comprehensive system implemented at this pilot project farm may not necessarily be adaptable to each distinct livestock village in Lembang. This is due to the undulating terrain and the intricate amalgamation of livestock farming within the constraints of residential land.

Despite various endeavors to convert livestock waste into energy, such as biogas, being introduced to local livestock farmers around Lembang, they frequently encounter technical obstacles within the conventional cattle farming systems in the village. Consequently, the implementation of this biogas solution in regions where livestock and residential areas intersect has proven to be a noteworthy challenge.

The complex socio-environmental issues have emerged over the past few decades since the inception of the milk harvesting trend in the Bukatanah Village in 2005. Since then, dozens of cattle farmers have joined in the trend, transitioning from their previous occupations as agricultural farmers, daily laborers, and equestrians. Although not originally a community of cattle farmers, the economic aspects of the people in Bukatanah Village have expanded as a result. However, the negative aspects, including environmental concerns, have been disregarded for a prolonged period, following the unsuccessful attempt of a top-down movement.

Community Development Approach

Developing from a community development course at ITB, the raised environmental problems were subsequently approached with design solutions. The process began by engaging in casual discussions with the local residents of Bukatanah Village. The enthusiasm of the local inhabitants to participate and educate themselves in processing products derived from cow dung steadily increased following the inaugural design dialogue held in Bukatanah Village in July 2022. Various segments of the community, including mother groups, livestock-rearing fathers, youth from the local youth organization, and local policy stakeholders, have demonstrated positive responses during each

training session and community gatherings. The residents' keen interest is apparent through their active engagement in training workshops and their initiation of a centralized discussion forum on the messenger platform, primarily involving 22 members from mother groups as representatives.

The initiative for the participatory design workshop originated from discussions conducted with community groups in November 2022 at the laboratory of the PP-PBL ITB in Bukatanah Village. This enthusiasm reached its pinnacle during the workshop training held in November 2022. The participatory design workshop was attended by residents of Bukatanah Village, representatives from KPSBU Lembang, and 8 research team members from PP-PBL ITB. With the increasing enthusiasm of the participants, the regular workshops expanded and formed into several groups actively involved in the production chain within the village. This began with the collection of raw cow dung material, which was then transformed into dried cow dung material, further processed by the mothers' community in the village. At this juncture, the system had not yet reached its final form, as the regular workshops continued to be held, and evaluation moments were shared among the villagers, as will be detailed in the next subchapter.

Page | 128

METHODS

This paper is dedicated to illustrating the significance of co-designing the concept in collaboration with the local community rather than imposing a top-down approach in the village. The process is shaped by a series of design ethnography observations, participatory design workshops, material exploration, and project evaluation stages. The outcome is a set of developed systems that offer mutual benefits for the local community, stakeholders, and the research team of the PP-PBL ITB. The design outcome is practically applied in the economic sectors of cattle farmers, aiming to enhance people's income generation through the lens of participatory design perspectives and social and anthropological development.

In response to the environmental challenges faced by Bukatanah Village since 2005, the research team from the Center for Cultural Product and Environmental Research, ITB (PP-PBL ITB), is striving to process cow dung waste into new materials that can be utilized to create design outputs and provide benefits. In the field of design, efforts are being made to address the problem by transforming cow dung waste into basic raw materials, such as bricks, and functional products like plant pots. This ongoing research is closely aligned with exploring the residents' potential in Kampung Buka Tanah, aiming to tackle the environmental issues prevalent in their living area.

COW DUNG DISCOURSE IN THE CATTLE FARMERS' COMMUNITY

A Continuing Social Approach in Understanding the Context

In preparation for executing the idea of exploring cow dung material, an ethnographic approach was undertaken to engage with the villagers in Bukatanah Village. This approach spanned from July to September 2022. The sequence of ethnographic field research was conducted by researchers from PP-PBL ITB and subsequently extended into regular workshops that were held collaboratively with the local residents. In response to the villagers' interest in transforming cow dung materials into sources of economic value, discussions regarding design activities commenced within the PPPBL team since 2021, involving the male cattle farmers. Subsequently, this concept evolved into a series of ethnographic fieldwork initiatives led by PPPBL's postdoctoral researcher.

Beyond the refinement of material processing techniques, we (PPPBL research team members) were driven by developmental initiatives, recognized the significance of comprehending the social framework and cultural norms within the local community's context. This encompasses the importance of co-generating ideas with the residents of Bukatanah Village through daily discussions throughout the ethnographic research, understanding the residents' day-to-day routines, and grasping the perspectives and aspirations of various community groups. This process of understanding is foundational and aligns the vision between researchers and the local community during the implementation of the community development project. This approach goes beyond a mere allocation of budget in a top-down manner; it takes into account the socio-cultural and economic dimensions within the targeted village.

Page | 129

During the ethnographic field research, a postdoctoral researcher from the PPPBL ITB research center initially attempted to immerse themselves in the daily life of the Bukatanah Village community by living with a cattle farming family. Mr. Dana (pseudonym) and his wife graciously allowed the researcher to participate in their daily activities, which began at 4 am and concluded around 9 pm. This close engagement enabled the PPPBL researcher to gain a comprehensive understanding of various perspectives, establishing connections at both the family and community levels within the village. Several local behaviors were noteworthy, such as communal meals (known as "*ngaliwet*"), which served as a platform for sharing ideas among villagers. This discovery had a significant impact as the "*ngaliwet*" tradition was later incorporated into the participatory design workshop, as described in the following paragraphs. Data collection primarily centered around Neighborhood Association Number 3 (RT 03) in Bukatanah Village, West Bandung Regency. The communities of cattle farmers are found in various parts of the West Java region and in other provinces. However, this research specifically focuses on Bukatanah Village, which stands out due to its unique geographical characteristics. The village's level terrain presents more challenges compared to cattle farmers located in flatter areas, making it an extreme case for addressing socio-environmental problems.

Following the initial phase of ethnographic field data collection, another period of ethnographic research was conducted by the PPPBL team to determine the appropriate forum for engaging a wider range of stakeholders in addressing the cow dung issue. Drawing insights from the community, which comprised cattle and goat farmers, vegetable growers, and daily laborers, including youth and adults, it became evident that there was potential interest among the mothers' groups in the village. In relation to these mother communities, male cattle farmers expressed interest in participating as cow dung suppliers for the village. These interests in deriving economic value from cow dung materials emerged during discussions among villagers, including informal conversations within family settings and community gathering places, such as local shops ("*warung*") and the village's milk station.



[1]

Figure 1. A gathering of mothers in Bukatanah Village, captured during the ethnographic fieldwork. (Photos by: PP-PBL ITB)

Based on an understanding of the villagers' daily routines, the scheduling of regular workshops is highly flexible to accommodate the schedules of both livestock-keeping and non-livestock-keeping residents. As a result, the residents of Bukatanah Village demonstrate significant enthusiasm and effectively adhere to the workshop training schedules. In the context of ongoing development, the research team from PP-PBL ITB and the residents maintain continuous communication and adhere to a regular creative work schedule every weekend. The heightened enthusiasm of the residents serves as a notable source of optimism for the PP-PBL ITB team as they continue to expand the range of products based on cow dung over time.

The design ideas as the output were put into material exploration which involving the mothers' community, the youth, and the cattle farmers in the village. Material exploration process was started from washing the cow dung and mix it with the adhesive materials. With a non-makers background, the villagers were attached to explore new techniques in shaping simple forms of such as mashed small and big balls made of mixed cow dung, and a casting technique that was tried on a flower vase forms. During the workshop, mothers often made intriguing statements, like this one from Nana (the woman wearing a pink outfit in Figure 2), a member of the mother community on November 26, 2022: "Oh, doesn't this look like dough when we make banana fritters? I think we can treat the mixture the same way."



Figure 2. (a) Sharing knowledge between workshop participants and PP-PBL ITB researchers; (b) Regular weekend workshops at the Laboratory of PPPBL ITB in Bukatanah Village. (Photos by: PP-PBL ITB)

The intention to market products based on cow dung remains an ongoing focal point, rooted in the multidisciplinary domains of design, engineering, and anthropology. The transition from basic forms to more intricate shapes, along with the discussions conducted during the workshops, has given rise to a community development movement centered around the design prototyping process. This method of material exploration has been refined to create textures composed of cow dung and adhesive materials that are easy to shape. The knowledge-sharing process during the participatory design workshops resulted in a shared perception and agreement among the locals. The mothers' communities took responsibility for forming the mixed cow dung material, while the male cattle farmers, assisted by their sons, agreed to take on the task of cleaning and washing the raw cow dung from the cows' cages.

The process of conceptualizing product forms and work division within cow dung processing is initiated by the residents of Bukatanah Village themselves, and this agreement among the villagers develops over time. For instance, there is an agreement that the processing of raw materials is carried out by livestock-rearing men (assisted by male youths), while the process of forming products is led by groups of mothers. This division of labor is collectively agreed upon and socially accepted (Naji, 2009) [1] during the concluding evaluation session at the PP-PBL ITB Laboratory after the regular workshops held every weekend in the village. Rather than solely dividing based on economic considerations, as discussed by Marx (in Ware, 1982: 43-71) [2], the sense of unity and inclusiveness in Bukatanah Village is a distinct feature observed throughout the research project, ensuring that no one is left behind.

Cow Dung Waste Exploration

As the technique for processing cow dung waste was introduced to the local community, participants in the regular workshops offered feedback, likening the texture of the processed material to everyday food items they encounter in their routines. Participants often compared the processed cow dung material to dough, a similarity they frequently observe in their day-to-day kitchen activities. The

phrases shared by participants serve as a source of inspiration for grassroots community development initiatives, highlighting the significance of using familiar language in socialization processes. Such communication strategies have proven effective in facilitating a reciprocal exchange of knowledge between the researchers from PP-PBL ITB and the participants in each workshop training. The use of simple, everyday language becomes a pivotal element in the training's success and fosters collaboration between the internal community and external entities (such as PP-PBL ITB) to address cow dung waste issues through the gradual and ongoing process of participatory design.

The processing of the material commences with the washing process and the separation of chemical components from animal waste, including ammonia gas, as well as other materials found around the cowshed (primarily soil or gravel). Essentially, the unique odor present in natural gases produced during the cow's digestive process evaporates and is separated during the washing and drying procedures. The neutralization reaction between acid and base serves as the fundamental basis for the processed functional product derived from cow dung waste. The collected water obtained from the washing and drying process will be subsequently refined into liquid fertilizer, filtered, or distilled to perfection in the final stages of material processing.

The cleaned cow dung material was subsequently compressed and dried to convert it into a coarse powder ready for processing, devoid of the characteristic strong odor associated with cow dung, as the chemical components from the animal's digestion process evaporate during drying. The natural physical and chemical processes occurring within the livestock's body result in a solid texture that is utilized for its distinctive attributes as a raw material for products crafted from cow dung. This extraction of texture from cow dung was blended with natural adhesive substances, including synthetic adhesives (as the simplest option).



Figure 3. (a) The process of skimming the texture of dried cow dung; (b). The mixing process of the dried cow dung into solid-textured material. (Photos by: PP-PBL ITB)

The incorporation of prepared cow dung and adhesive can be processed into a textured material resembling dough and molded using predetermined molds. The merger of organic materials and basic tools is intended to facilitate the locals of Bukatanah Village in processing cow dung waste material, inspired by the local feedback that received from participants in the regular workshops on the weekends.

RESULTS

Indirectly, this newly initiated system is collaborative and serves as a fresh source of inspiration for the residents of Bukatanah Village to create and explore new opportunities for home-based businesses in the future. The process of promoting the method of transforming raw cow dung waste into a product does not mark the culmination of the research efforts conducted by the PP-PBL ITB team. The introduced alterations concerning cow dung production material within the economic realm of Bukatanah Village may present distinct cases from the well-known "cottage industries" (Prentice, 1983: 17-48) [3], which primarily expanded from the agricultural sectors present in their vicinity. The anticipated economic and social outcomes (Fischer, 2000: 197) [4] seem to be influenced by design and technological interventions in the village, appearing as a bridge to address environmental problems through the perspectives of design and socio-anthropology.

Page | 133

This paper underscores the significance of comprehending the local context to generate the engagement of the relevant stakeholders in embracing the design movement within the research project. Building on the insights of Gupta and Ferguson (1997) [5], the undertaken ethnographic fieldwork shed light on local perspectives and behaviors that served as a keen tool for comprehending the contextual intricacies in the research domain. By examining the noteworthy roles of the anthropological approach in the developmental research project, this paper also portrayed the enduring movement within the inhabitants of Bukatanah Village.



Figure 4. (a) Developed design outputs in the laboratory in Bukatanah Village; (b). Showcase of PP-PBL's cow dung products at Singapore Design Week 2022. (Photos by: PP-PBL ITB)

As a result, the accumulated cow dung waste in Bukatanah Village is currently being actively processed to transform it into the primary material for crafting functional products within the village. These functional products, including lamps and electronic speakers made from cow dung material, have been featured in various design exhibitions both nationally and internationally. Through the utilization of simple techniques and everyday items, the community of mothers in the village is becoming adept at the shaping and finishing steps during the crafting process. The active participation of the local community and residents in the design process offers a promising resolution to the environmental issue of excessive livestock waste in the region. This initiative is driven directly by the various communities within the village.

DISCUSSION AND CONCLUSIONS

Based on the prevalent environmental issues in the everyday landscape of the Lembang area in West Java, the exploration of livestock waste materials holds the potential to pave the way for design innovation. In the process of comprehending the field, it becomes inevitable to address the environmental concerns in the targeted village, which inherently involves socio-economic considerations. In this context, design and anthropological perspectives emerge as bridges that connect the interrelated issues, with the creation of functional products using abundant cow dung waste serving as a means to tackle the problem. In practical terms, the processing of cow dung material must incorporate sustainability principles and seamlessly integrate into the daily activities of the local community. Therefore, the concept of participatory design undertaken by the PP-PBL ITB team becomes of paramount importance.

When a transition occurs from conventional customs to "modern" interventions (Bendix, 1967) [6], as covered in a development or research project, conflicts may arise concerning the preservation of long-standing practices. In this context, the customary practice of disregarding cow dung waste in the fields is expanded and explored through material investigation, which is linked to the design-making process. Examining Prentice's concept of cottage industries (1983) [3] that have commonly evolved over decades, the people of Bukatanah Village exhibit their influence within their society by engaging in the processing of cow dung material and aligning with the prevailing trend in the village.

The familiar presence of cow dung in various forms within the village, particularly in terms of common-sense air pollution, becomes ingrained in the consciousness of the Bukatanah Village residents. The connection between bodies and actions mediated by the materials involved in the making process was also discussed by Rahardiani (2022) [7], within the context of bamboo-producing villages and their governmentalities. In this sense, the cow dung as a material object and the people's bodies mutually absorbs and intertwine, forming a system that empowers various spheres of society (biological, social, political, and economic). The emerging discourse of political influence within the cattle farmers' society initially reveals distinctions among groups based on their skills in cow dung handling and formation processes. Therefore, in any developmental endeavor, a comprehensive understanding of the target environment and people is essential, with ongoing assessment processes in place.

Notably within the social sphere, male cattle farmers, who tend to focus on the raw material production process, support the mothers' community in their efforts to shape the cow dung clay. This cooperation functions both ways, with the mothers' community acknowledging the men's role in producing the raw material, especially since washing the cow dung requires physical strength typically associated with men, a habit cultivated from their work on cattle farms. In contrast, forming the cow dung clay is viewed as a more patient and detail-oriented activity often associated with feminine qualities. Both the men's and women's communities in the village exert their influence and contribute to the societal structure (ibid.).

Regarding the various layers of interconnected concerns surrounding environmental problems, the PP-PBL ITB research team identified a blind spot at the end of cattle farming routines, where unsolved socio-environmental issues tend to accumulate. By employing ideation processes within the domain of design knowledge and utilizing approaches that encompass material exploration and participatory design, the challenge posed by the accumulation of cow dung waste – previously a significant environmental pollution concern in the Lembang District of West Bandung Regency – has been

effectively tackled. The result of these efforts is the successful transformation of cow dung waste into practical, everyday-use products.

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Page | 135

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