

# Sustainable Design of Crafts: Empowering Rural Craft-preneurs through Optimization of Natural Resources of Pandans in Indonesia

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Received	Accepted	Published
29.06.2023	25.02.2024	30.02.2025

<https://doi.org/10.61275/ISVSej-2025-12-02-03>

## Abstract

Many research have examined craft and design research on global issues, environments and life cycles. However, studies that focus on the creative industry of natural craft products is somewhat rare. Recently, this has become a priority research area for economic transformation of Indonesia, interested in promoting a green economy based on ‘Pandanus tectorius’; a natural leafy plant that produces pandans used to produce craft-based products.

Observations show that this craft is in need for more public and local government attention to harness the full potentials of the Pandanus tectorius copious. It is argued that if the natural potential of the surrounding environment is adequately managed, then, it could create economic opportunities that encourage high demand for long-term improvements in the economies of the communities. This paper examines this issue to determine the value, function, and benefits of products using pandan leaves from an aesthetic, design, economic, environmental and socio-cultural perspectives.

It employs Participation Action Research (PAR) methodology engaging design thinking in its implementation. The Creative Preneurship Kriya Pandan (CP-KP) theoretical framework is used to achieve the objectives. CP-KP is concerned with the potential integration of natural resources and human resources of regional artisans, as well as the creative response of the communities to produce eco-sensitive designs.

The findings reveal that (1) design development is based on aesthetic and usability requirements; (2) the economic benefits of pandanus products are diverse and valuable; (3) increased sales of pandanus products can reduce plastic waste; and (4) there are socio-cultural benefits of people becoming proud to be artisans and pandanus cultivators because they raise environmental awareness and gain economic benefits.

**Keywords:** Design Thinking, Craft-Preneur, Sustainable Design, Environmental Design, Pandanus Tectorius

## Introduction

This research on natural craft products is directly related to eco-friendly products and global issues concerning the environment and life cycle (Kobayashi, 2006) by referring to the National Research Master Plan (RIRN 2017-2045), which prioritizes the Green Economy (Dossche et al., 2018). In this context, each country is responsible for anticipating the problem of environmental pollution caused by excessive plastic waste. It is time for us to change our consumption habits so that plastic products that accumulate and are difficult to decompose can be reduced. Using environmentally friendly products (natural products) is one of the efforts that can be made (Mäkelä & Aktaş, 2022).

This study, which focuses on increasing the capacity and quality of craft products, is expected to aid in realizing the resilience of creative culture and the economy, particularly in the Pangandaran Regency area. It was conducted based on the findings of the following issues: (1) a lack of community and local government attention to the copious potential, benefits, and functions of *Pandanus tectorius*; (2) a lack of knowledge about the utilization and processing of natural resource potential as well as creative design; and (3) a lack of knowledge of appropriate technology production management in materials processing and techniques, which impacts upon productivity and product quality.

This research aims to help develop designs that meet the aesthetic needs and usability of craft products made from pandanus. Its objectives are

- (a) To discover opportunities for economic benefits from the application of pandanus products that are diverse and valuable;
- (b) To discover benefits for the environment because the sale of pandanus application products will reduce excessive (waste) plastic; and
- (c) To facilitate socio-cultural benefits; and
- (d) To make the community proud to be pandanus craftsmen and cultivators because it can increase environmental awareness while also providing economic benefits.

## Theoretical Framework

The term *kriya* has been paired with "craft," which means work, action, or creation. *Kriya* is an activity that is generally closely associated with the creative process (the hand power and mind power, as described by William Morris and John Ruskin), such as the processes of knowing, exploring, designing, or making, which contain aesthetic values (beautifying) as well as socio-cultural values (Gustami, 1992; Irianto, 2000; Haldani et al., 2008).

On the other hand, when "craftpreneurship" is linked to the development of the local, national, and global economic, political, and cultural landscapes, it necessitates clarity regarding the position of craftwork in research. This includes criteria, roles, and the impact of craftwork in the society concerning the well-being and human dignity. It also involves the vision and relevance of crafts to the spirit of the times, the advancement of crafts along with their interdisciplinary nature, economic aspects, entrepreneurship, openness, high fashion, utility, and quality standards as perceived by the society, which demand increasingly higher standards (Haldani et al., 2008). In this context, craftpreneurship serves a dual function in the society as a reflection of culture and as a component of the economic system.

The craft sector is one of the fields that can withstand economic challenges due to its inherent creative spirit. Unsurprisingly, crafts fall within the creative industries cluster initiated in the United Kingdom by a task force formed during Tony Blair's leadership. Richard Florida states that creativity is the ultimate economic resource (Simatupang, 2010).

The design thinking-craftpreneur, as explained in the method section, is used to complete descriptions and discussions about experiential learning, practical experience, socially inclusive society empowerment, and craft attitude. Design thinking has been around since the 2000s. Design thinking is in high demand and increasingly applied to new design and human resource challenges (Baker & Moukhliiss, 2020). Since then, design thinking has fueled innovations in the fields of art and management design (Knight et al., 2020; Colombo et al., 2017), business

(Geissdoerfer et al., 2016), and social theory and practice (Hoolohan & Browne, 2016).

However, design thinking is ubiquitous (Bjögvinsson et al., 2012). Every approach in everyday life in solving problems involves thinking (Shapira et al., 2017; Lynch et al., 2021). Indeed, design thinking is also about demonstrating how and why something works so well. Human activities are so detailed and specific nowadays that they change the stability of life in a way that supports the improvement of their lives based on their various professions.

For the past few years, design thinking has been the subject of teaching, research, and real-life applications in almost every domain and field of education, research, and industrial endeavor (Pande & Bharathi, 2020; Leavy, 2010). In this context, this research creates design thinking tools that discuss the specific characteristics of 'kriya-pandan creative entrepreneurship' as it evolves (Hendriyana, 2021; Colombo et al., 2017). The design thinking tool is intended to help designer-entrepreneurs decide about their start-ups. In this research method chart, design thinking focuses on ideas, concepts, innovations, and prototypes.

The elaboration on the philosophy of design thinking in the context of usefulness rests on the socio-historical point of view of the field of design that relates to the field of philosophy. This research did not try to explain the linkages between the theories of the two fields—even though there are linkages, it requires intensive study—instead, it sought to explain the connection of substantial conceptual phenomena as a meeting point between the two fields of science. It starts with an understanding of the world of design, which is not only appreciating design works as mere artifacts but also an integrated view that covers cultural values and thoughts, and the accompanying socio-economic changes. Design thinking is not a standalone product but a living order of civilization. Even historians argue that design is an integrated and synergistic form of people, Nature, and social environment in a broad and substantial sense (Walker, 1989).

Design is inseparable from the aspect of creativity as the spearhead of design. Substantively, it cannot be separated from human ideas, namely elements of reason (ratio, logic, thoughts, ideas, and so on) and elements of taste (creativity, intuition, inspiration, taste, value-values, and so on). In viewing the current development of design and creativity, there has been an established mutual relationship, namely as an order of physical and cultural works, which are born from various considerations of the thoughts, ideas, tastes, and souls of designers. They are supported by external factors concerning discoveries in science, technology, art, social environment, values, culture, aesthetic rules, economic and political conditions, and projections of future developments. Its role is increasingly important in the order of physical cultural work, primarily to support creative economic growth and increase the quality of human life.

On the one hand, when referring to efforts in applying innovative approaches to design to produce innovative products, design innovation in the context of creativity is the solution to the deadlock of creativity. This design innovation is based on exploring the superiority and uniqueness of indigenous materials and design ideas to be developed into products with originality and new functional values. On the other hand, the world of creativity indicates the convergence of concepts and practices from creative design works, originating from individual talents collaborating with cultural industries on a large scale through the use of new technological media in the digital era, which is a new economic knowledge as a way of using new interactive media in the consumer community.

The emergence of this new-faced world of creativity results from changes in the global technological and economic fields, the widespread use of various forms of interactive media (such as high-capability computers), and the commercial exploitation of IPR-based goods and services. In short, design is a modern object culture. In essence, it is built by involving aspects of human images in viewing the world, mastery of technology, understanding of science, and aesthetic values. Starting from creative images, humans build their world—with the support of science, technological proficiency, and tangible aesthetic values—into products that are functionally useful and meaningful in human civilization (Sachari & Sunarya, 1999; Sunarya, 2014).

Sustainability in the context of craft experiments discusses the growing awareness of environmental conservation among the public, which has led to a positive response in the development of science and technology. Understanding of conservation, recycling systems, and efficiency in exploiting natural resources are triggered by growing environmental issues such as water pollution, air pollution, natural biodiversity loss, and global warming. Craft plays a significant role in the utilization and functional placement of these developments in science and technology.

The principle of sustainability is applied from start to finish, from the manufacturing process to the final product produced. In addition to formulating appropriate, effective, and environmentally friendly production methods, the craft industry has begun to seek and develop various alternative materials capable of replacing or reducing dependence on natural resources that have long been used as industrial support materials. This is rooted in the awareness of the rejuvenation of natural resources, which often requires a long time or cannot be rejuvenated.

Fletcher (2012) states that a designer's role is no longer limited to merely creating a product but has evolved into someone who can provide education, act as a facilitator, and actively engage as an activist, particularly in environmental issues. A designer's performance can begin with a simple step, considering the selection and use of alternative materials in realizing a design idea. The development of alternative materials in the craft industry has become an intriguing focus due to the potential of materials that can be unearthed and developed, even from unconventional and uncommon sources (Priadi, 2015).

## Literature Review

This critical review aims to synthesize and analyze the key findings of the researchers who have examined this issue, shedding light on the current state of knowledge and identifying gaps in our understanding of this issue.

In the study of contemporary aesthetics, value dimensions that go beyond the visual and sensory aspects emerge. Human beings, as tactile creatures, possess a non-material dimension (tacit) that must be learned and harnessed, especially in creating forms and ideas that can evoke emotional and aesthetic stimuli leading to feelings of pleasure and desire, ultimately resulting in decisions involving the exchange of goods, services, or economic value (Haldani et al., 2008).

On the one hand, Affendi (2000) asserts that traditional values continue to serve as a foundation for symbolic aesthetic references and visual inspiration. However, the creation and shaping of forms, in a broader sense, cannot remain confined to traditional norms; it requires fresh perspectives and innovative, creative ideas due to the complexity and progressive nature of the challenge in a democratic sense. Globally-minded ideas, concepts, information, and artistic sensitivity must possess a captivating style. Craftsmen who solely prioritize functionality may not receive a positive response from the community (market).

On the other hand, Anas (2009) adds that these changes, while highly feasible, must also be embraced. The concept of tradition is becoming increasingly fluid and mutable, transitioning from a limited repetition of constant and non-inventive past values to an evolving concept linked to organizers, humans, environments, and their changes. In this context, tradition can undergo processes of adoption and adaptation influenced by various underlying factors, both internal and external. The resilience of tradition at this stage depends on its compatibility with the environmental situation and conditions and its adaptability in response to social dynamics, including demographic, technological, and economic changes. This understanding of tradition places it within the discourse of modernity, no longer in a dichotomous relationship but in an adaptive, dialectical, and conceptual one.

Amidst the complex and rapid dynamics of contemporary times, various discourses have emerged, including efforts to redefine the essence of contemporary craft. In the West, the phenomena and concepts described above are often referred to as contemporary craft or craft art, distinguishing them from handicraft and native/rural craft. Recent developments in the Western craft scene have shown a growing tendency towards free-form craftworks. For instance, in many discussions, new terms have emerged within the craft world, such as art craft,

craft design, and traditional craft, each showcasing their existence both in practice and philosophically.

As cited in Buchori (2005), Frayling also pointed out a shift in the understanding of craft between the 1950s and the 1970s. In the 1950s, the craft was expected to be functional, made from natural materials, and produced individually, with little regard for fashion, manual, rural, etc. However, in the 1970s, the craft could also be non-functional, synthetic, collaborative, high-fashion, mechanical-electrical, urban, etc. This implies that several transformative phenomena and challenges are even more pronounced in the present era and into the future.

Ariffin et al. (2023) provide foundational insights into the relationship between traditional craft practices and the natural environment. They emphasize the significance of considering the local context when designing sustainable solutions. Their work underscores the importance of aligning design strategies with the cultural and environmental attributes of the region in Malaysia. They highlight the need for a holistic approach incorporating indigenous knowledge and local materials concerning innovations such as design, materials, techniques and uses. Innovation in creating actual traditional crafts needs to be balanced to maintain the authenticity of traditional crafts.

Building upon the ideas of Ariffin et al., and Magalhaes (2020), Maida et al. (2022) explore the potential of pandanus as a sustainable resource for rural craft-preneurs. They emphasize the economic and ecological advantages of utilizing pandanus fibers in various artisanal products. Maida and Magalhaes demonstrate how optimising pandanus resources can increase income for rural communities while promoting environmental conservation.

In contrast, Lee et al. (2021) argue that while pandanus-based crafts may offer economic benefits, resource depletion and over-exploitation challenges exist. They stress the importance of implementing sustainable harvesting practices and responsibly managing natural resources. This perspective adds a crucial dimension to the discussion, highlighting the potential pitfalls of unchecked resource utilization.

Atahau et al. (2022) delve into the social dynamics of rural craft-preneurs in specific local contexts. They analyze the role of social networks and community collaboration in enhancing the sustainability of pandanus-based enterprises. Their findings underscore the need to consider social factors alongside environmental and economic aspects when designing interventions to empower rural craft-preneurs.

However, the literature reveals specific gaps in our understanding of sustainable design for rural craft-preneurs. First, there needs to be more research that explores the long-term environmental impacts of pandanus resource optimization. While some studies touch on responsible resource management, a comprehensive assessment of the ecological sustainability of pandanus-based crafts still needs to be provided. Additionally, integrating digital technologies and market access for rural craft-preneurs still needs to be explored. As the world becomes increasingly interconnected, it is necessary to investigate how digital platforms and e-commerce can empower rural artisans and expand their market reach while preserving traditional craft practices. Moreover, while some researchers have touched upon the importance of cultural preservation in sustainable design, a deeper exploration of how to balance cultural heritage with innovation is warranted. This is particularly relevant in the context of rural craft-preneurs, where traditional knowledge plays a significant role in craft practices.

In conclusion, literature on sustainable designs that empower rural Craft-preneurs through Pandanus natural resources provides valuable insights into the subject. Researchers like Ariffin et al., Magalhaes, Maida et al., Lee et al., and Atahau et al. have contributed to our understanding of this complex field. However, there needs to be more in our knowledge, particularly regarding long-term

environmental impacts, digital integration, and the delicate balance between cultural preservation and innovation.

## Research Methods

This research uses Participatory Action Research (PAR) design in this craft and design research (Swann, 2002). Participation research focuses on the concept of participation. It regards human involvement as individuals who collaborate to make activities a reality through the participation (Namsomboon & Jitcharat, 2021) of artisan partners and pandanus cultivators in the form of experiences, imagination, intuition, ideas, and daily activities. This research model involves research partners with a focus on community involvement in research involvement; in the field, it necessitates the direct active participation of the pandanus craft group to collaborate in creating more valuable pandanus application products.

The study population consists of pandanus-tectorius plants and pandanus craftsmen in fourteen villages spread across a 44.85 km stretch of Pangandaran's 91 km coastline. The study aims to create an eco-design product using natural materials from *Pandanus tectorius*. The research analysis employs several relevant elements related to other sciences, such as art, design, management, economics, socio-cultural, community motivation, and the environment. The design thinking model considers relevant conceptions during the practice-led research stage. The method chart (Fig. 01) aids in explaining the interpretation of arts and crafts from the three domains of collaborative practice, epistemology, and ontology (Zhan & Walker, 2019). This method also aids in consideration of the cognitive concept elements attained by eco-design (Macdonald & She, 2015) and leads to a design attitude toward environmentally friendly application products (Cheah & Phau, 2011; Cerri et al., 2018; Prakash et al., 2019; Nguyen et al., 2017).

Questionnaires were distributed to 100 respondents via online media to gather public opinions on plastic waste originating from household waste. The respondents were selected based on a variety of activities that were centered around the theme of this research. They were chosen as key informants due to their extensive everyday experiences in the subject matter. This is done to gauge public interest in environmentally friendly products that can help reduce excessive plastic waste.

Based on the research problems and objectives, the framework for discussing the findings of the Kriya-Pandan (KP) research includes four types of knowledge: (1) experiential learning; (2) practical experience; (3) craft attitude (Sanscartier, 2020); and (4) socially inclusive societies empowering women (Georgeson et al., 2017). These four aspects are thoroughly examined using the following approaches: (a) creative culture theory applied to art, craft, and design; (b) creative emotions and local community collective expressions; and (c) eco-design, eco-friendly products, environmental design, and sustainable design. In the meantime, the practical action stage is carried out by considering several elements, such as ideas, concepts, and forms; users' use and solutions; the value of novelty/innovation, aesthetics, significance, and meaning; and so on (Fig. 1).

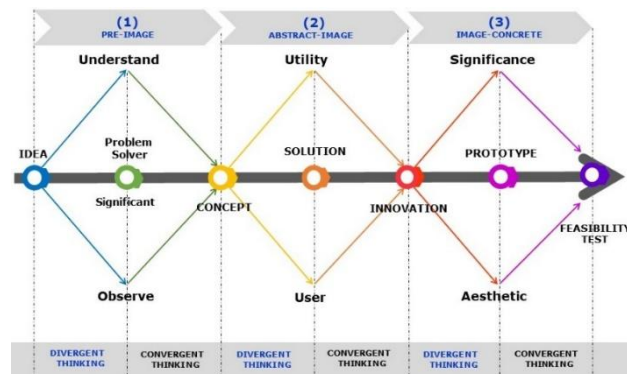


Fig. 1: Design Thinking Method Illustration Hendriyana, (2021:59-65)

Source: Adopted From Swann, 2002

## Findings and the Discussion

### Laboratory Test on Pandanus Woven and Ropes

Traditional craftsmen's products are frequently dismissed because they need measurable quality standards. According to pandanus craftsmen who met potential buyers of pandan bag products, the product's strength is measured by stepping on and pulling the bag as hard as possible until the bag is damaged. The laboratory test results are critical in instilling confidence in potential buyers who frequently doubt the strength of the pandanus craft product.

The Pandan material's strength was tested in a laboratory at the Textile Center, Ministry of Industry and Trade, West Java Province. This laboratory test consists of a woven material unit strength test, woven strength, color strength, rubbing strength during dry and wet rubbing, and heat resistance strength when boiled.

**Table 1:** Laboratory Test on Pandan Woven Original Sheet

Source: Author

No	Type	Tensile Strength		Stretch		Friction Strength	Tear Strength	Color Fastness			Ministry of Industry: BBT Laboratory Test Bandung
		Woven N (kg)/5 cm	A sheet of material	Woven (%)	A sheet of material	Load 12 Kpa	Trapezium	K	B	S M	
1.	Original	283 (28,8) 380 (38,7)	42,1 (4,29)	4,6 4,3	2,7	30000	40 (4,1)	4	4-5	4	No.916/EV/VI/2019
2.	Bleached	256 (26,1) 210 (21,4)	27,2 (2,77)	5,0 3,3	2,4	30000	24 (2,4)	4	4-5	4	No.917/EV/VI/2019
3.	Dyed	162 (16,5) 174 (17,7)	46,7 (4,76)	3,51 2,89	3,75	-	22 (2,2) 11 (1,1)	3	4	3	No.1128/EV/VII/2019
4.	Woven +1 -1	287 (29,3) 293 (29,9)	21,3 (2,17) 37,7 (3,84)	3,3 4,6	2,6 4,0	-	30 (3,1) 41 (4,2)	4	4	5	No.2255/EV/VII/2020

The results of the strength of the pandanus woven type differ, which is classified into three types: original pandanus, bleached pandanus, and dyed pandanus. The original type of woven pandanus was declared to be the strongest compared to dyed and bleached. As shown in Figure 3 (h), woven pandanus is combined with original pandan material and dyed pandanus to provide stable strength and add aesthetic value (patterned).

**Table 2:** Laboratory Test on Pandan Rope

Source: Author

No	Type	Tensile Strength/hl (cN)	CV, (%)	Stretch (%)	CV, (%)	Ministry of Industry: BBT Laboratory Test Bandung
1	8 mm pandan rope	19700	17,0	28	12,0	No.1331/EV/IX/2021
2	5 mm pandan rope	11700	12,0	19,0	17,0	No.1332/EV/IX/2021
3	4 mm pandan rope	18200	17,0	33,0	12,0	No.1333/EV/IX/2021
4	3 mm pandan rope	8980	14,0	23,0	20,0	No.1334/EV/IX/2021

The same test was performed on the type of pandan rope. Weaving techniques are used to achieve a more stable rope strength based on its load and function (as shown in Fig. 8).

The following are the findings of a feasibility study of Pandan's raw materials and application products in the form of a terrace chair product. The chair strength test was performed manually by occupying it with people of varying weights, as shown in Table 3.

**Table 3:** Load Strength Test for Pandan Rope Terrace Chair

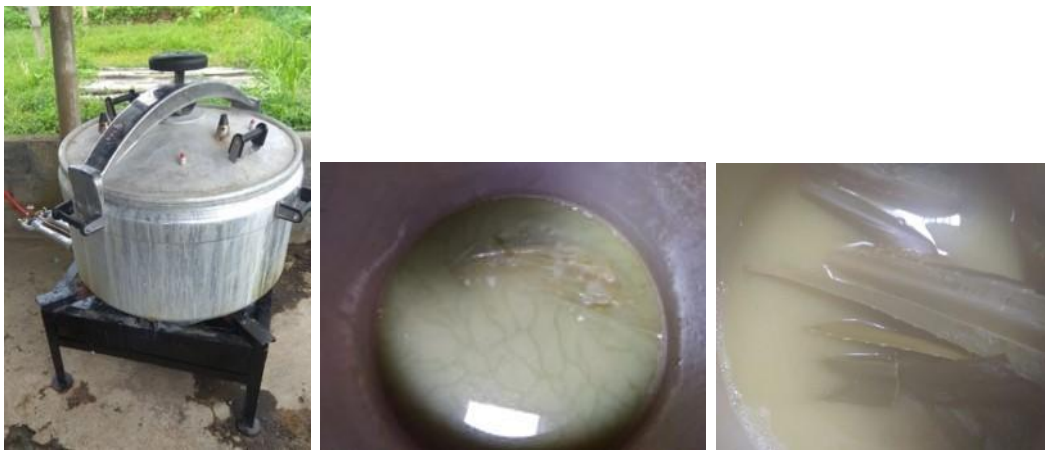
Source: Author

No.	Explanation	Description
1	Individuals weighing 74.15 kg sat on the chair for 15 minutes.	The rope's position showed no damage, and the seat was firm.
2	Individuals weighing 70.70 kg sat on the chair for 15 minutes.	The rope's position showed no damage, and the seat was firm.
3	Individuals weighing 68.35 kg sat on the chair for 15 minutes.	The rope's position showed no damage, and the seat was firm.
4	Individuals weighing 62.70 kg sat on the chair for 15 minutes.	The rope's position was not damaged, it did not stretch or loosen, and the position of the rope and weaving were still strong.

**Table 4:** Testing The Product's Strength on Hot Temperature

Source: Author

No.	Method	Temperature	Duration	Description
1.	Pandan boiled under pressure in hot water	100°C	45 minutes	Boiling water caused the color of the pandan leaves to turn yellowish green, but the condition of the leaves remained strong, and the structure remained unchanged.
2.	Pandan boiled under pressure in hot water	140°C	90 minutes	Boiling water caused the color of pandan leaves to turn yellowish green, but the condition of the leaves remained strong, the structure remained strong, and the leaves were not crushed.



**Fig. 2:** Hot Temperature Strength Test by Boiling Technique

Source: Authors

The strength test results on the rope terrace chairs showed that pandanus rope in weaving produced a more robust quality against a relatively large load and resistance to heat temperatures up to 140 °C.

### ***Kriya-Urban Preneurship***

Kriya is one of the professional fields that produce products for the needs of specific people's lives, including aesthetic, spiritual, vernacular, functional, socio-cultural, and economic conditions (Hendriyana, 2022; Muhadiyatiningasih & Fathonah, 2020; Bisyarda, 2016); Firmansyah, 2016; Kudiya & Atik, 2020; Buchori Z., 2010; Arynov et al., 2022). Kriya is derived from Sanskrit, which combines elements of personality and skill, as in Javanese: crafty (perigel), very detailed (ngerawit), complicated, diligent, patient, painstaking, and thorough. This concept of kriya is derived from the background of the palace community's life activities (Hendriyana, 2022:339; Mahardika, 2010; Anshori, 2013), which is well known for its highly valued traditional palace style. Along with the cultural development of urban communities, kriya works, known as Kriya Urban, have also adapted to the needs of urban communities.

Kriya is developing in the academic environment in Indonesia and is divided into four categories. The first category is traditional kriya made in the context of ethnic culture; the second is religion and rituals; the third is folk crafts; and the fourth is kriya made by artists and designers (Hendriyana, 2022; Buchori, 2010). In the fourth category, university-created kriya is classified according to the materials used: wood kriya, leather kriya, batik and weaving kriya, textile and fashion kriya, metal kriya and jewelry, bamboo and rattan kriya, ceramic kriya, and Tosanaji kriya. The names or terms of kriya pandan have not been included in the list of competence and occupational craftsmanship names in universities' academic and vocational environments. Currently, only weaving crafts are listed, and their availability is restricted to the primary and secondary education offices.

As defined above, Kriya is one of the academic competencies of two-dimensional and three-dimensional visual works demonstrating conceptual intelligence. Furthermore, kriya is oriented toward utility, significance, and aesthetics in achieving goals and targets that focus on user needs, solutions, and innovation (Hendriyana, 2022). Kriya evolves with the times to meet the cultural needs of the palace community and has vast market potential in local and national markets and exports.

### **The Economic Potential of Pandanus Tectorius**

Pandan is one of the materials used in the creation of craft items. Pandanus is one of the names of a family of plants known as the Pandanaceae. This genus contains various pandanus species that live in open areas in the lowlands at an elevation of 20-600 meters above sea level in almost all of Asia, from the eastern tip of Asia to the Pacific islands. Pandanus tectorius (Pandanaceae) populations are primarily found in coastal areas and community plantation lands in Pangandaran Regency. Pangandaran has a 91-kilometer-long beach with 21 beach tourism destinations and a coastal land area of 283.55 ha (RPJMD 2016-2021). According to a field survey, the sandy land in the western region of Pangandaran Regency is overgrown with Pandanus tectorius trees for approximately 44.85 kilometers. Pandan plants grow wild and thrive throughout the area.

The Pandanus is distinguished by its trunk, which can grow 4–14 m tall and has green leaves measuring 90–150 cm long and 4–8 cm wide. In one year, Pandanus produces 10–300 leaves per stem. In the first-year phase, the leaf growth reached 10–90 cm, whereas the stem and branch growth reached 10–90 cm and 2-80 cm, respectively. Phase 4, 5 to 9 years, the development of upright followed the growth stems reaching 5–12 m in height. This growth information was gathered by calculating the number of leaves and measuring the distance between marked leaf scratches and flower stalks. The age of the pandanus plant can be estimated based on these markings. The following stage is the flowering phase, lasting 40 years or more. Male plants produce about 30 branches and flowers yearly, while female plants produce about 16 branches and flowers every two years.

The pandan fruit is shaped like a bunch (*dompolan*) and contains between 76 and 100 seeds in each bunch. Each seed contains 8-10 embryos (tiny seeds that will later develop into new plant shoots), though many die and do not develop new shoots because insect larvae kill

them. Pandan leaf processing typically begins with cutting pandan leaves, which are then boiled, washed with clean water, dried in the sun, colored, and made into woven or rope.

Pandanus is used in religious rituals known as the Pandanus War Ceremony by the Bali Aga Tribe. In other religious rituals, pandanus, made of mats, is used to wrap the corpse after it has been wrapped in a shroud to complete the death ceremony. Pandanus leaves are now mainly used for weaving and roping and to make mats, hats, bags, baskets, multifunctional storage boxes, and furniture. Furthermore, pandan fiber can be used as cement composite reinforcement, paper composite reinforcement in place of wood planks, and concrete tile composite reinforcement.

The process of working on Pandan application products, from taking leaves to becoming pandanus woven (Fig. 3) and becoming pandan rope materials, can be explained in the implementation of this applied research (Fig. 4). The following are the stages of pandan rope processing:

- (1) Fresh pandan leaves are cleaned of thorns, cut into size, boiled, soaked in cold water, and thoroughly washed with running water;
- (2) Pandan leaves are then dried in the sun to dry;
- (3) Dried Pandan leaves are then twisted one by one according to size using simple manual tools;
- (4) The double twisting stage is the merging of one gyre into a rope (*telampar*) using a swivel technique;
- (5) Pandan rope spools come in various sizes (diameters of 2 mm, 3 mm, 4 mm, and 7-8 mm).



**Fig. 3:** Weaving Processes of Pandan (*Pandanus Tectorius*)

Source: Authors

Description:

- |  |                     |
|--|---------------------|
| a = collecting the pandan leaves               | e = boiling process |
| b = thorny pandan leaf shape                   | f = drying process  |
| c = thorn removal process                      | g = weaving process |
| d = leaf cutting processes into specified size | h = woven pandan    |



**Fig. 4:** Processing The Pandan Ropes (*Pandanus Tectorius* Rope)  
Source: Authors

Based on field data, community empowerment (Creative-preneurship) resulted in four groups of pandanus craftsmen from Cibenda Village, Legok Jawa Village, Ciparanti Village, and Kertamukti Village. The craftsmen are divided into three groups based on the type of work they do:

- a. Group of craftsmen who provide raw materials, namely the Tumpang Sari farmers who supply wet and dry raw materials (Figs. 5 and 9).
- b. Group of craftsmen who provide ready-to-use materials in the form of woven and rope (Figs. 3, 4, and 6).
- c. The craftsmen who make products comprise a sample maker and a production team (reproduction) (Figs 7-8).

The development of kriya pandan for these villages generates additional revenue for the local community. In addition to their primary jobs as farmers and brown sugar producers, they can become pandanus craftsmen in their spare time. On average, the craftsmen work five days a week, with a yield capacity of dry leaves harvested and dried around 50kg/m<sup>2</sup>. Here is the formula:

- a. When the market price reaches its maximum of 17,500/kg, the extra income of the crafting community is  $50 \times 17,500 \times 4 = 3,500,000/\text{month}$ , utilizing only labor and avoiding costs and materials. They only do the processing.
- b. When the market price drops to 11,000/kg, the extra income for the crafting community is  $50 \times 11,000 \times 4 = 2,200,000/\text{month}$  (16 working days by two people) using only labor, no costs for materials, and only processing the material. The price of Rp. 11,000 is relatively equal to their earnings as brown sugar producers.
- c. According to data collected in the field, the average amount of dry leaf processed at harvest time is as follows:  $23 \text{ craftsmen} \times 30\text{kg/mg} = 690 \text{ kg/mg}$ ;  $690 \times 4\text{mg} = 2,760 \text{ kg/month}$ ;  $2,760 \times 10 \text{ months} = 27,600 \text{ kg/year}$ .
- d. According to data from 2021, 19 house pandan craftsmen in Kertamukti Village have intercropped pandanus up to 7.59 ha, totaling 5,815 pandanus trees.

The community of the pandanus craft group appears to get additional livelihoods that can help meet their growing daily financial needs, as seen by the four points (a–d) above. Implementing the pandanus intercropping scheme can also guarantee that the supply of raw material requirements may be regulated sustainably.



**Fig. 5:** The Activities of Craftsmen Processing of Pandan Raw Materials  
Source: Authors



**Fig. 6:** The Activities of Pandan Woven Craftsman  
Source: Authors

### **Innovation Design, Sociocultural, and Environmental Benefits of Pandanus Tectorius**

The design, socio-cultural, and environmental benefits of pandan craft application items contribute to their added value. This is based on the idea and concept of the national research master plan (RIRN 2017-2045), namely the priority of the Green Economy. Research on handcrafted goods manufactured with natural components is closely tied to eco-friendly products. Additionally, research on nature-based material craft items will address global environmental and life cycle issues (Kobayashi, 2006; Dossche et al., 2018). In this situation, every nation is responsible for preparing for climate change. It's time for individuals to change how they consume to stop plastic garbage from building up and becoming harder to decompose.

The activities of weaving and making pandan mines are similar to those carried out by the Weaving Meigu Liangshan artisans' group in China (Li et al., 2021); these two pandanus craftsmen and traditional weaving have their uniqueness through the expression of their respective cultural values.

The goal of this research's utilization of the potential of natural and human resources is to create Kriya Pandan (KP) creative products based on creative entrepreneurs, eco-design, and sustainable design. Innovative KP product development unquestionably calls for using a variety of new ideas, concepts, materials, techniques, prototypes, and finished products.

Innovation and the value of novelty sometimes refer to profound ideas and concepts but rather to the importance of advantages for users in urban and rural areas. The quality of a product is not defined by the perceived value of its concept and theory or its kitschiness but by its significance and usefulness to the community (Hendriyana, 2019-2021). The importance of this kind of work often lies in the use of inclusive and empathetic design, connecting to diverse societal living spaces and creating new societal living spaces from solid and caring social interactions (Viderman & Knierbein, 2020). The processing of these concepts, ideas, and innovations can be combined to create the following product prototypes.



**Fig. 7:** Pandanus Storage, dan Standing Lamp  
Source: Authors

Description: Left, the position of the shopping bag is neatly folded and simple, so it looks fashionable. On the right, the position of the open shopping bag is filled with groceries.



**Fig 8:** Multifunctional Basket and Patio Chairs  
Source: Authors

### Sustainable Design

In this context, sustainable design is more concerned with the product itself—an eco-friendly product that does not harm the environment (Khoso et al., 2021). Additionally, using raw materials with a sustainable supply, such as those obtained from intercropping agriculture and periodic harvesting methods, is related to sustainable design and climate change (Mahaarcha, 2019).



**Fig. 9:** Planting Pandan Seeds Will Help Ensure a Sustainable Supply of Raw Materials  
Source: Authors

## Conclusions

This practice-led Kriya-Pandan (KP) produced two products: (1) the Pandanus application craft product, the end result of exploration and experimentation that tested a variety of design thinking elements, including ideas, concepts, and forms; users, usability, solutions, the value of novelty, innovation, aesthetics, significance, and meaning; and (2) the "design thinking of Creative Preneurship KP" creative process model, which develops into a creative process model that involves several components, such as creative ideas, people, products, markets, venues, re-productions, support, and sustained.

This research concludes that the design development complies with the aesthetics and usability requirements. Due to the variety and value of pandanus products, there are also financial advantages. Another thing that can be inferred is that the environmental advantages of growing pandan product sales will reduce plastic waste. The final point that can be drawn is that there are socio-cultural advantages for people who feel pleased to be pandanus craftsmen and farmers since they earn financial benefits and raise environmental awareness.

## Acknowledgements

This article is one of the publications of the multi-year applied research projects in 2019, 2020, 2021, and 2022 funded by The Ministry of Research, Technology, and Higher Education – Kemendikbudristekdikti.

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