

# IJAD

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## Appreciation

International Journal of Architecture, Art and Design (IJAD) was firstly launched in January 2023. This journal aims to disseminate academic, research, creative works to the public. A wide range of art and design disciplines are welcome to publish which is not limited to creative products (crafts, textiles, ceramic, media and digital artwork, including other design creation); creative spaces (architecture, interior, landscape, built-environment, urban planning, urban design, and other forms of place-making); creative processes (design thinking, design solutions, and innovation); including other creators who wants to disseminate their art and design creation. This second volume (No.2) was issued between July to December 2024. Five articles were presented across various aspects starting from cultural heritage: ancient ornaments from Si Thep World Heritage Site; place-making design: a small shop exhibition design; and digital media design: 3D computer Game Design, and the Design of a Webcomic; and ending with the Bio-Circular Green (BCG) Economy for Jewellery Design.

On behalf of the IJAD editorial board and committee, I would like to express my appreciation to all authors for their contributions. I hope our 2nd issue of the second volume of IJAD 2024 will inspire all readers with insightful knowledge and good practices. It is ready to be launched soon by the end of this year.

Witiya Pittungnapoo  
Editor-in-Chief



## Style and Origin of Upholders as Carrying Dwarfs at the Khlang Nai Archeological Site, Si Thep, Phetchabun Province

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### Abstract

This article presents a study of the style and origin of stucco patterns of upholders as carrying dwarfs decorated on the base of religious place at Khao Klang Nai archaeological site located in Si Thep Historical Park, Si Thep District, Phetchabun Province. Results based on the investigation of style and origin suggested that the patterns of upholders as carrying dwarfs were influenced by the South Indian art that came to play a role in Southeast Asia in the same period of the Dvaravati and ancient Khmer arts which blended with the Si Thep local culture and skills of artisans to develop its uniqueness known as the Si Thep school of art.

**Keywords:** Upholder, Carrying Dwarf, Si Thep, Dvaravati

### Introduction

Khao Khlang Nai archaeological site is a Buddhist religious place assumed to be a stupa or a vihara built with laterite. It was located in the Si Thep Historical Park, Si Thep District, Phetchabun Province. Khao Khlang Nai is a significant archeological site in the inner city of Si Thep since the early construction of the city until the 18<sup>th</sup> Buddhist century. It was a combination of Dvaravati art and ancient Khmer art and developed into the unique style of the Sri Thep artisans. Initially, Khao Khlang Nai was built according to Theravada Buddhism in respect of the first Dvaravati culture. Later, possibly in the 14<sup>th</sup> century it changed to Mahayana Buddhism due to the discovery of many Bodhisattva sculptures and signs of repairs made during that period, including the stucco decoration on the base of the building in the shape of carrying dwarfs and Kranok Pak Kud as remains on the west and the south.

The origin of the name Khao Khlang Nai that followed the local name of an area of mounds, a feature of the ancient site that was once covered by trees. The word "Khlang" came from the belief that the place was once a storage site for valuable items or weapons in the city. It was thus called a different name to another place referred to as Khao Khlang Nok (Fine Arts Department, 2001).



**Figure 1** A scene of the Khao Khlang Nai archaeological site

Source: Thanawat Taonoke, 2024

### Style and Origin of Upholders as Carrying Dwarfs

Dwarf sculpture was presumably influenced by the ideology that spread from India and Lanka. Dwarf sculpture in Brahmanism accompanied gods but in a lower position. In India, dwarf sculpture had been constructed since ancient times, mostly as sculptures of important images commonly found in the Amaravati and Gupta periods with dwarf figures decorated on the base of the building. They might originate from the native people or a group of laborers being made as upholders to guard religious places. The upholder or carrying dwarf was an ideology carried on from Greek Mythology for "Atlas" who held the earth on his shoulders, reflecting that the stupa is similar to the center of the universe. It was assumed that Si Tep artisans had probably received the idea through India (Praphat Chuvichean, 2023).

The main interests were at the southern and western bases that were decorated with stucco sculpture decorations in the patterns of flora, carrying dwarfs and animals, and likely the exquisite decoration on the whole stupa with other stucco figures such as Buddha image, disciples, fairies, animals in Himmapan forest, and other patterns of the ornaments as well. The dwarfs at Khao Klang Nai were created in human and animal heads alternately as the features of ancient craftsmanship. It was assumed that originally Khao Khlang Nai had a stupa and a vihara on top with the same features as the ancient site at Wat Khlong, Mueang Khu Bua, Ratchaburi Province.

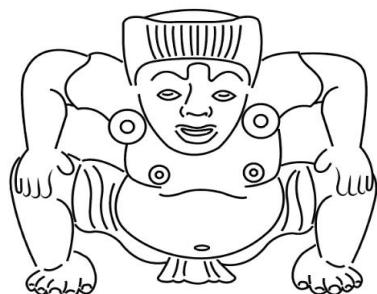
The dwarfs at Si Thep city are unique and different from elsewhere in that they were the stucco in the shapes of carrying dwarfs, carrying animals including elephant, lion, monkey, cow, and buffalo. The carrying dwarfs have various facial expressions and emotions such as calm, smiling, and stressful different from elsewhere with only plain face, as found at Wat Nakhon Kosa in Lopburi, the archeological sites in Nakhon Pathom, and the ancient city of Khok Mai Den in Nakhon Sawan.

The emotional facial expressions of the dwarfs at Si Thep city were created by craftsmen in those days with a sense of humour, thus showing their skills and wisdom. Each carrying dwarf and carrying animal had a unique character and dress. They wore a piece of cloth similar to a loincloth but not a shirt, a hat or a turban around or on their heads. They wore a piece of cloth similar to a loincloth but not a shirt, a hat or a turban around their head. They wore neck jewellery and big round earrings reflecting abundances as influenced by Indian art. As for the stucco of carrying animals, it was assumed that in the past there were different types of animals living in the forest around this area, or different types of animals were raised for agricultural use. Observations on animals' facial expressions and poses made it possible for the artisans to convey these appearances beautifully (Thawatchai Chanpaisansil, 2014). The survey of carrying dwarfs on the south and western sides reported a total of 40 retained figures; 35 on the southern and 5 on the western sides (Anurak Depimai, 2014).



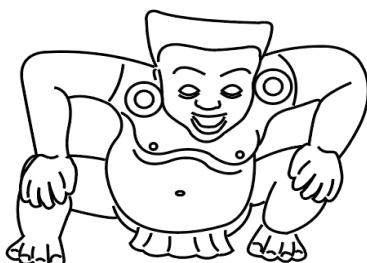
**Figure 2** Image of a carrying dwarf with human head, smiling face, and slight neck bend

Source: Thanawat Taonoke, 2024



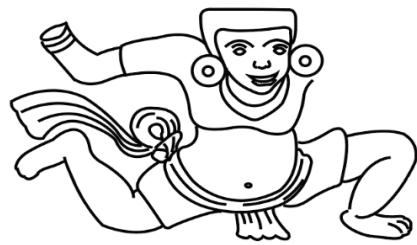
**Figure 3** Image of a carrying dwarf with human head and looking straight ahead

Source: Thanawat Taonoke, 2024

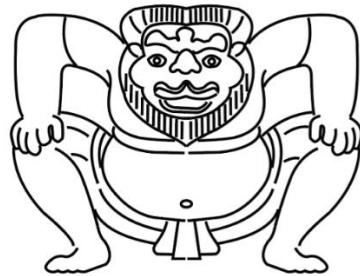


**Figure 4** Image of a carrying dwarf with human head, smiling face, and slight body bend

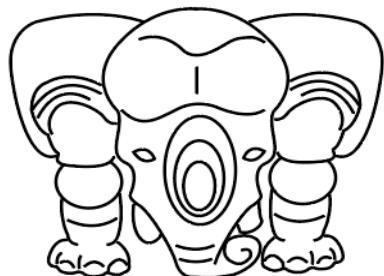
Source: Thanawat Taonoke, 2024



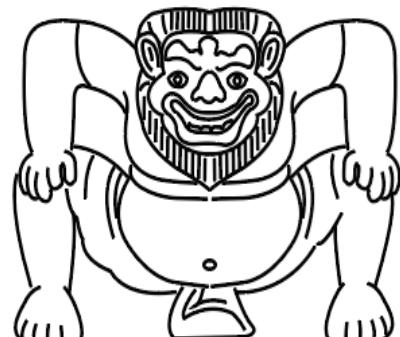
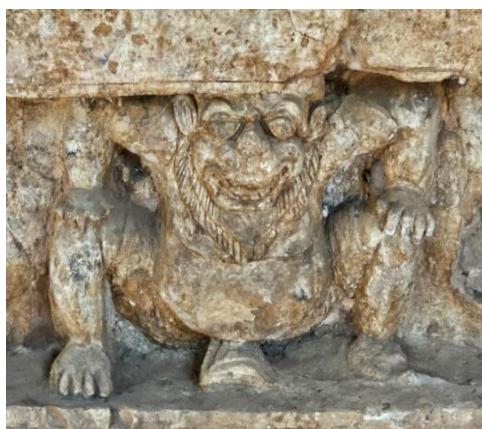
**Figure 5** Image of a carrying dwarf with human head, getting down on one knee  
Source: Thanawat Taonoke, 2024



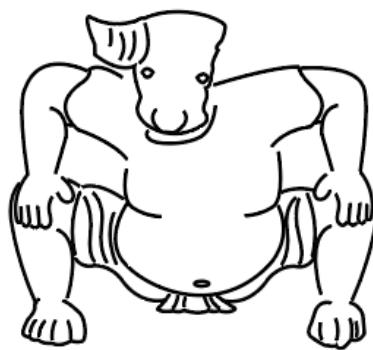
**Figure 6** Image of a carrying dwarf with lion head  
Source: Thanawat Taonoke, 2024



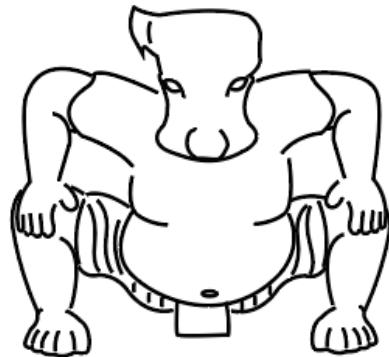
**Figure 7** Image of a carrying dwarf with elephant head  
Source: Thanawat Taonoke, 2024



**Figure 8** Image of a carrying dwarf with lion head, smiling face  
Source: Thanawat Taonoke, 2024



**Figure 9** Image of a carrying dwarf with cow head, neck bend  
Source: Thanawat Taonoke, 2024



**Figure 10** Image of a carrying dwarf with cow head, looking straight ahead  
Source: Thanawat Taonoke, 2024

## Conclusion

The style and origin of upholders as carrying dwarfs at Khao Klang Nai archaeological site of Si Thep, Phetchabun was a study that collected data on the style and origin of stucco patterns of upholders as carrying dwarfs decorated on the base of the Khao Klang Nai religious place at Si Thep Historical Park, Si Thep District, Phetchabun Province. Results based on the investigation of style and origin suggested that the patterns of upholders as carrying dwarfs were influenced by South Indian art that came to play a role in Southeast Asia in the same period of Dvaravati art and ancient Khmer art which blended with the culture and skills of local Si Thep artisans to develop its uniqueness. Their figures had different facial expressions and poses, presumably due to the sense of humor of artisans who created the works.



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Anurak Deepimai. (2014) Stucco Sculpture of Carrying Dwarfs with the Figure of Human, Elephant, Lion, Monkey, Cow, and Buffalo. *Journal of Phetchaburi Arts and Culture*, 2(3): 23-29.



## **Small Shop Design Decoration Education: Ling Sum Raan Limited Partnership**

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### **Abstract**

This objective of a creative design work was to explore the design and decoration approaches for small retail shops or kiosks and to propose design recommendations for the kiosk of the business establishment, Ling Samran Limited Partnership, within the context of the retail space at Mae Fah Luang International Airport in Chiang Rai Province. The creative design process is divided into five steps. 1) Researching information about the brand and the business establishment, Ling Samran Limited Partnership. 2) Studying concepts and theories related to the design of small retail shops or kiosks. 3) Engaging in the creative design process. 4) Designing and creating 3D model renderings using 3D design software. 5) Summarizing the results and providing recommendations for the design and decoration of the kiosk for Ling Samran Limited Partnership.

The outcomes of this creative design work include a kiosk design concept that incorporates the unique identity and characteristics of the brand to communicate its image effectively. The design style chosen is a "Minimal and Fun Vibe," harmoniously integrating a monochromatic or natural warm colour palette, including soft colours such as cream and white, contrasted with shades of rich beige-gold. This reflects simplicity, with the beige-gold shade symbolizing natural elements that enhance the aesthetic appeal. On the right side of the kiosk, there will be a large iconic sculpture of a Lava Stone and a Banana, representing the brand's primary ingredient and the innovative method of grilling bananas on lava stones. This feature serves to attract the attention of passersby, acting as a strategic marketing communication tool. Additionally, the Lava Stone sculpture can serve as a seating area for customers, while the Banana sculpture functions as an information center, providing details about the menu, promotional news, and housing a cooking area with a smoke extraction system. This ensures the retention of the signature aroma of "Ling Samran Grilled Bananas" without disturbing passengers inside the terminal. The kiosk's space is clearly defined from adjacent shops by laying wood-patterned vinyl tiles in a lava stone shape, reinforcing the distinctive identity of Ling Samran Grilled Bananas.

**Keywords:** Kiosk, Identity Design, Small Retail Shop Design



## Introduction

Currently, the number of entrepreneurs is on the rise, driven by changes in societal conditions and government policies that emphasize the promotion and support of entrepreneurship at all levels of business. As a result, entrepreneurs play a vital role in driving the nation's economy. At the regional level, SMEs (Small and Medium Enterprises) are primarily involved in the agricultural industry, producing and processing local raw materials. SMEs are thus considered the backbone of the overall national economy.

In the current environment of intensifying business competition—whether in terms of 1) Quality, 2) Price, or 3) Technology—entrepreneurs must adapt by incorporating knowledge from various disciplines to enhance organizational efficiency and improve competitiveness. Ling Samran Limited Partnership is an SME in Chiang Rai Province that aims to develop its brand to increase recognition and differentiate itself from competitors by clearly defining its identity and expanding its product outlets through the establishment of small retail shops or kiosks. The goal is to facilitate product sales, create a distinctive and aesthetically pleasing store environment, and enhance customer access to goods and services. The overall atmosphere should be suitable for the retail space within Mae Fah Luang International Airport in Chiang Rai Province, catering to a diverse group of customers. This creative design project aims to identify strategies for brand image enhancement and to propose design concepts for small retail shops or kiosks that reflect the unique identity of Ling Samran Limited Partnership within the context of the retail space at Mae Fah Luang International Airport. The design will emphasize creativity and communication through design methods that enable competitive differentiation and sustainability in the market. Based on these reasons, the researcher is interested in studying the design and decoration approaches for small retail shops, with a case study of Ling Samran Limited Partnership.

## Objectives

1. To explore design and decoration approaches for small retail shops or kiosks for Ling Samran Limited Partnership.
2. To propose design and decoration recommendations for small retail shops or kiosks for Ling Samran Limited Partnership.

## Concepts and Theories

### 1. Concepts and Theories on Corporate Identity

Corporate identity refers to the identity of an organization, developed through a systematic design process that aligns with the business objectives. The design of a brand's identity includes the systematized use of 1) logos, 2) typography or fonts, 3) colours 4) imagery, and 5) shapes and forms, which together shape the organization's image to meet its vision (Waranya Kaewthum, 2017). Corporate identity serves to create a memorable relationship between products and services and their target consumers. Additionally, corporate identity involves the structured and clear communication of the organization's image, fostering unity and mutual understanding within the organization among its employees and customers (Sahaphop Halamchiak, 2016).



## 2. Corporate Identity Design

2.1 *Logo*: A logo is a symbol or trademark that represents an organization and can convey certain core values in a way that reflects the personality and status of the organization.

2.2 *Font/Typography*: Typography functions similarly to images in conveying meaning and establishing the personality of an organization. Fonts can be selected from existing typefaces or custom-designed, with specifications for the number of typefaces, their weight, and the creation of a typographic system to ensure appropriate use across various formats.

2.3 *Colour Scheme*: One of the most crucial elements in helping people recognize an organization is its colour scheme, with over 80% of recognition attributed to it. The precise selection of colours and colour codes is essential for consistent application.

2.4 *Image*: Images play a key role in making the corporate identity more engaging. This can be achieved by using similar shapes with subtle variations or by emphasizing key messages through guided imagery. The style of all images, including photographs, illustrations, and animations, should be consistent with the organization's personality and appropriately suited for each occasion.

2.5 *Shape & Form*: Shapes can include geometric forms like circles, triangles, and rectangles, as well as organic forms inspired by nature. These shapes can be used to reinforce the organization's identity.

## 3. Concepts of Rebranding Strategy

Rebranding is a strategy for altering or improving a brand's image. This strategy involves changing the brand's identity from its previous image, which may have been inappropriate or failed to resonate with the target audience. When the brand's communication does not achieve its objectives or effectively convey its message, the brand's position in the consumer's perception may not align with the organization's goals. The rebranding process typically occurs after a business has been operational for a period of time. Rebranding can be defined as a strategy or process of modifying or changing a brand's image when the existing image fails to effectively communicate or create the desired awareness between the company and its target consumers. In such cases, the organization must seek new strategies to present a fresh brand image that can once again capture the consumers' attention (Tarika Sirichai, 2018).

## 4. Principles of Retail Design

Retail design refers to the architectural characteristics and interior design of small retail stores. The primary objective is to efficiently manage the space to facilitate product sales. This involves using design concepts and creativity to maximize effectiveness by carefully planning the store layout, optimizing space utilization, and strategically positioning elements within the store to ensure smooth traffic flow and efficient operations. Additionally, the interior atmosphere should create a positive and memorable experience for consumers.

Key considerations in the retail design process include designing the usable space to align with the type and style of the products and services offered. Furthermore, selecting appropriate materials is crucial for presenting the organization's image effectively (Piyawan Pinkaeo and Patchariyaporn Puengpak, 2022).



## Summary of the Creative Design Process

1. Analysis of the Spatial Context: Retail Stores within Mae Fah Luang - Chiang Rai International Airport Based on a study of customer satisfaction at Mae Fah Luang - Chiang Rai International Airport (Saengduean Ongsaenkham, 2018), it was found that: 1) The variety and adequacy of retail stores and restaurants within the airport were satisfactory. 2) The pricing levels of products and services within the airport were considered appropriate. 3) Store owners and operators within the airport were polite and had good interpersonal skills. However, the overall satisfaction in these three concepts showed the lowest average scores. The study suggests that Mae Fah Luang - Chiang Rai International Airport should emphasize the importance of customer service, friendly interactions, and offering quality products at reasonable prices. Additionally, it should ensure that there is a sufficient variety of products available to meet customer needs. This information can be utilized in the design and decoration of the small retail store for Ling Samran Limited Partnership.



**Figure 1:** The Process of Spatial Context Analysis for Retail Stores within Mae Fah Luang - Chiang Rai International Airport

Source: [www.easy-travelworld.com](http://www.easy-travelworld.com)



The Results of the Creative Design Process are divided into three parts as follows:

### Part 1: Brand Image Rebranding Strategy

This involves developing a new brand image by evolving the existing logo to better communicate with a new target audience. The aim is to present a refreshed brand image that can more effectively captivate and engage consumers.



**Figure 2:** Results of Brand Image Rebranding  
Source: Saran Hema, 2024

### Part 2: Design and Decoration Results for the Small Retail Store

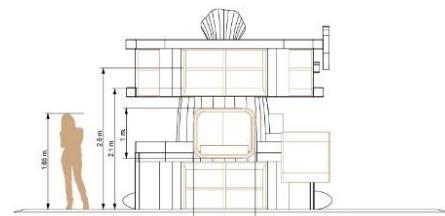
The design and decoration concept for the kiosk features a "Minimal and Fun Vibe" style, utilizing a monochromatic colour scheme with warm, natural tones such as soft colours, cream, and white, contrasted with rich gold hues. These colours reflect simplicity and gentleness, evoking the natural world and enhancing the visual aesthetics. The rich gold shade is one of the key colours for 2024.



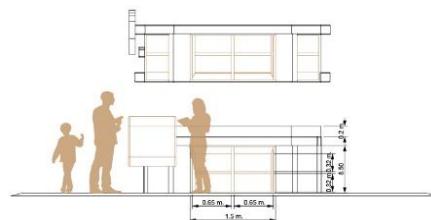
On the right side of the kiosk, there is a large iconic sculpture of Lava Stone and Banana, designed to communicate the brand's main ingredients and the innovative use of lava stone for grilling bananas. This element not only attracts attention from passersby but also serves as a check-in point for customers, contributing to the marketing strategy. Additionally, the Lava Stone sculpture can function as a seating area, while the Banana sculpture serves as an informational point, providing menu details, promotional news, and including a cooking area with a ventilation system to maintain the distinctive aroma of "Grilled Banana Ling Samran" without disturbing passengers. The use of rubber flooring with a lava stone pattern delineates the kiosk's space from other stores, reinforcing the brand identity of Grilled Banana Ling Samran from Ling Samran Limited Partnership.



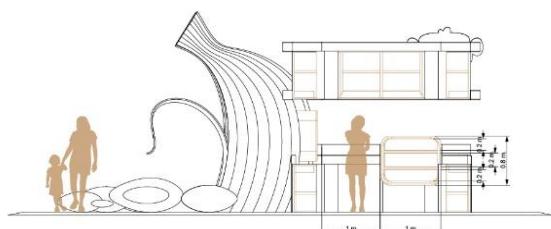
CUTTING PLANE (LEFT)



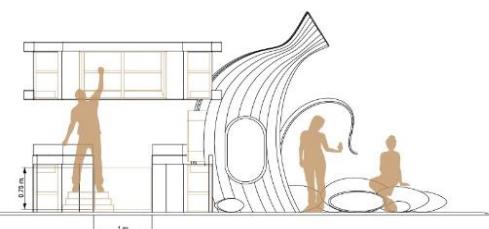
CUTTING PLANE (RIGHT)



CUTTING PLANE (FORNT)



CUTTING PLANE (BACK)



**Figure 3:** View of the Kiosk for Ling Samran Limited Partnership

Source: Saran Hema, 2024



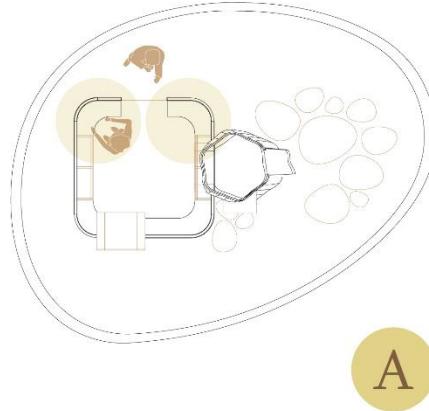
### Part 3: Zoning and Spatial Relationships for Activities and Processes within the Store

The store is divided into five zones, labeled A-E, as follows:

**Zone A: The process of stocking store ingredients. The store's ingredients are categorized into two types:**

Dry/Material Ingredients: Items such as product bags, paper cups, skewers, plastic cups, and straws.

Fresh Ingredients: Items such as bananas (bunches), sweet potatoes (packs), and banana dipping sauces (bottles). Fresh ingredients are stored in a refrigerator.

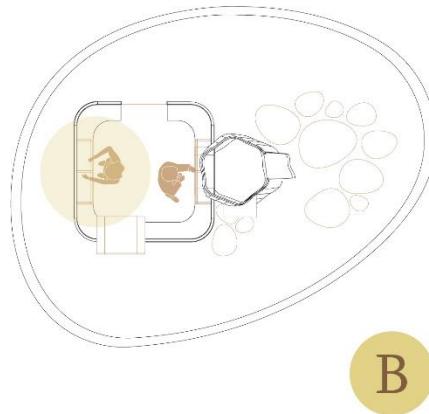


**Figure 4:** Zoning - Zone A

Source: Saran Hema, 2024

### Zone B: Ingredient Preparation Process for Grilled Banana Menu

When ingredients arrive at the store, staff clean and peel the bananas, then place them in containers and store them in the refrigerator. For the sweet potato menu and beverage menu, the ingredients are pre-processed by the manufacturer. Sweet potatoes come in packaged form and can be immediately used for baking and sale. Beverage ingredients are supplied in barrels for use in the slushy machine.

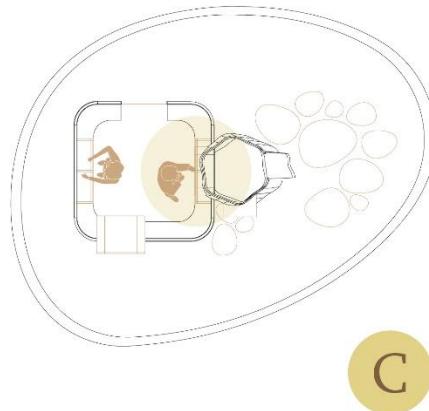


**Figure 5:** Zoning - Zone B

Source: Saran Hema, 2024

### Zone C: Banana Grilling and Sweet Potato Baking Process

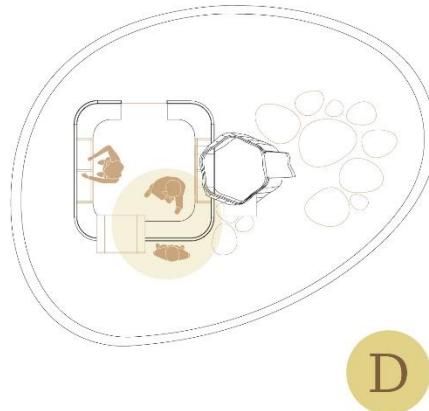
Staff take the bananas out of the refrigerator and place them in a hot air oven, then grill them on an electric stove with volcanic stones. For the sweet potato menu, ingredients are taken out of the pack and placed in the hot air oven. Both menu items are served in paper cups for sale.



**Figure 6: Zoning – Zone C**  
Source: Saran Hema, 2024

#### **Zone D: Order Taking / Payment / Product Delivery Process**

Staff responsible for taking orders, processing payments, and delivering products are stationed at the front of the store. Both staff members can switch roles and cover for each other as needed.

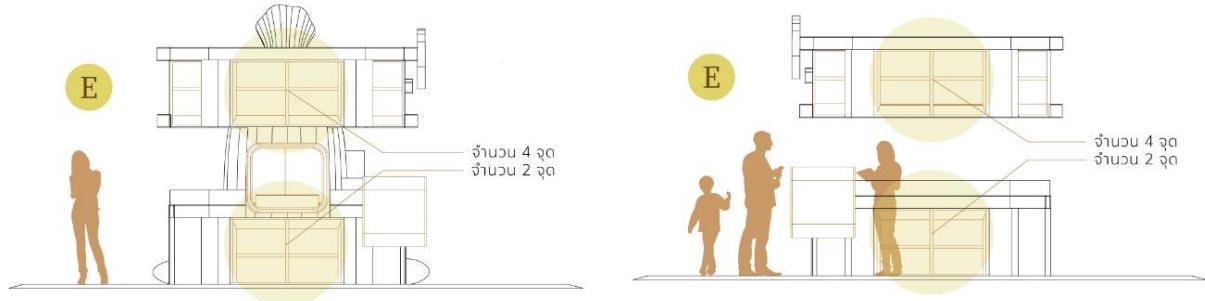


**Figure 7: Zoning - Zone D**  
Source: Saran Hema, 2024

#### **Zone E: Kiosk Storage Shelves**

The kiosk has a total of six storage points:

- Two shelves at the lower part of the kiosk for heavier equipment.
- Four shelves at the upper part of the kiosk for dry ingredients, packaging, and lighter



**Figure 8: Zoning - Zone E**  
Source: Saran Hema, 2024



## Layout of Equipment and Usage Areas for the Kiosk

1. Kiosk (Left Side) includes the following functional areas:

### 1.1 Order/Payment/Delivery Area

Located at the front of the kiosk on the left side, this area includes a cash register, a counter with drawers for valuable items, and a bar stool for staff to adjust their posture.

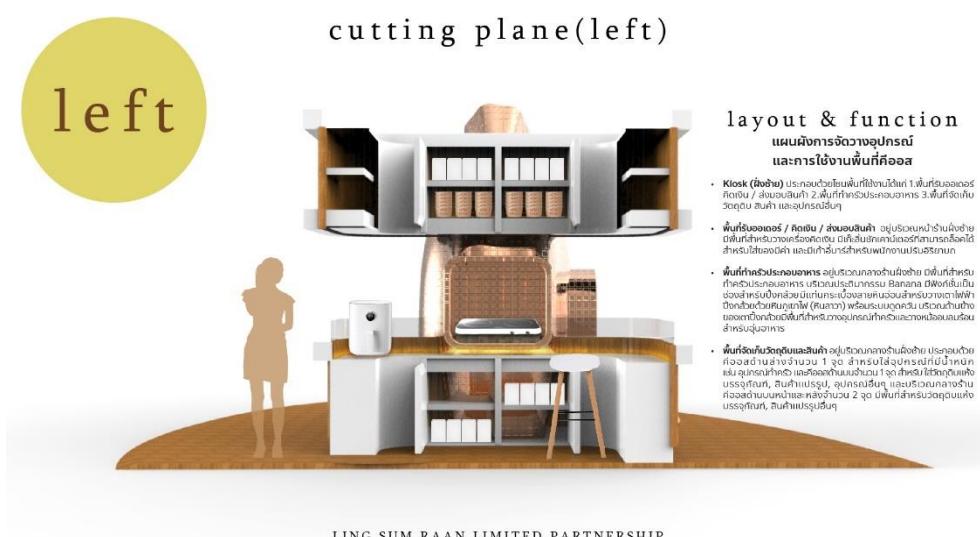
### 1.2 Kitchen/Preparation Area

Situated in the middle of the left side of the kiosk, this area features space for food preparation. The Banana sculpture functions as a spot for grilling bananas. There is a marble tile platform for placing an electric grill with lava stones, along with a smoke extraction system next to the grill. This area also includes space for kitchen equipment and a convection oven for warming food.

### 1.3 Storage for Ingredients and Products

Located in the middle of the left side of the kiosk, this area includes:

- One lower shelf for storing heavy equipment such as kitchen tools.
- One upper shelf for dry ingredients, packaging, processed goods, and other equipment.
- Two upper shelves at the front and back of the kiosk for additional dry ingredients, packaging, and other processed goods.



**Figure 9: Layout of Equipment and Usage Areas for the Kiosk (Left Side)**

Source: Saran Hema, 2024

## 2. Kiosk (Right Side) Layout:

### 2.1 Product Display Cabinet

Located at the front right of the kiosk, this area is designed for displaying additional brand products. It follows the Golden Zone principle, considering eye-level placement, with three staggered shelves and lighting. There is also a bar stool for staff to adjust their posture.

### 2.2 Kitchen Area (Food Preparation)

Situated in the middle of the right side of the kiosk, this area is designated for food preparation and ingredient handling. The floor is covered with soft white tiles for easy maintenance, and there is a food waste disposal chute connected to a waste bin below to ensure cleanliness. Adjacent to the product display cabinet is the slushy machine and a storage space below for ingredients.

## 2.3 Storage for Ingredients and Products

Located in the middle of the right side of the kiosk, this area includes one lower section for heavy items like kitchen equipment and one upper section for dry ingredients, packaging, processed products, and other items. There are two upper storage spaces at the front and back of the right side, designated for dry ingredients, packaging, and other processed goods.



**Figure 10:** Layout and Usage of Equipment and Space in the Kiosk (Right Side)

Source: Sarun Hema, 2024

## Summary of Design Results

1. Sculpture: On the right side of the Kiosk, there is a large iconic sculpture of Lava Stone and Banana. This sculpture aims to convey a representation of the main ingredients of the store and the innovation of grilling bananas using lava stones. It attracts the attention of passersby and serves as a check-in point for customers, which is also a marketing strategy. Additionally, the Lava Stone sculpture can serve as a seating area for customers.

2. Homemade: The Banana sculpture functions as a cooking station with a grill for bananas using volcanic stones (lava stones), equipped with a smoke extraction system. This setup preserves the brand identity of "Grilled Banana Ling Samran" by providing fresh and delicious offerings without causing odors inside the passenger terminal. At the front of the Kiosk, there is a product display case designed according to the Golden Zone principle, considering eye level. It features three graduated shelves with lighting, ensuring that products are always fully displayed to create a fresh appearance and encourage customer purchases.

3. Friendliness: On the left side of the Kiosk, the space is kept open with a high clear glass partition, allowing passersby to view inside the store. This design element lets customers observe the process of grilling bananas with volcanic stones (lava stones), showcasing the special and meticulous care in every step. It also reduces the gap between customers and the brand, making the brand feel more accessible. Additionally, the Banana sculpture functions as an information display, providing menu details and promotional updates via an LED screen that fits the design. This screen rotates with graphics and content related to the brand.



**Figure 11:** Overall View of the Kiosk, Ling Samran Co., Ltd.  
Source: Saran Hema, 2024

## Recommendations

1. It is suggested to evaluate the design results based on consumer feedback.
2. For those interested in applying creative design results like this, it is recommended to study and analyze additional variables related to small retail design, such as materials used and colour selection. This will help achieve a kiosk design that is well-suited to business owners, meets the needs of target consumers, and attracts customers.



## Acknowledgements

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# 3D Computer Game Design of the Palette Knight Inspired by the Impressionistic Artistic Style

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## Abstract

Many impressionist paintings capture the ephemeral nature of life and the ephemeral experience of human existence. Artists of the impressionist movement sought to convey these fleeting moments through rapid brush strokes, vibrant colours, and an emphasis on atmosphere. This study aims to explore impressionist art and use these insights to design a 3D game environment within Unreal Engine 5, aiming to create an immersive and interactive world that reflects the aesthetic and emotional characteristics of late 19th-century French art by translating impressionist techniques and themes into a digital format. The game will provide players with a new experience of impressionism in motion, allowing them to actively engage and interpret this art form. This study approach involves integrating online data collection and references to academic research, supplemented by resources from the Naresuan University Library, to ensure that the design is insightful and contextualized. This study not only explores the transformative potential of game environments as spaces for artistic expression, but also aims to promote interactive learning experiences where players engage with art and culture. This project aims to define new frontiers in the depiction of historical art trends by promoting active participation and interpretation of impressionistic art through interactive media, combining both education and entertainment.

**Keywords:** Impressionist paintings, 3D game, Unreal Engine 5, Game Environments

## Introduction

Impressionism, a revolutionary art movement originating in late 19th-century France, is renowned for its focus on capturing ephemeral moments, emphasizing the transient qualities of light, colour, and atmosphere. Unlike earlier art forms that focused on meticulous realism, Impressionist painters embraced a loose, expressive style characterized by quick, visible brushstrokes, soft colour transitions, and an emphasis on natural lighting. Artists like Claude Monet, Pierre-Auguste Renoir, and Edgar Degas often painted outdoors, immersing themselves directly in nature to portray scenes as they appeared in a given moment. They pioneered the use of “brush strokes,” where distinct colours were applied side by side without blending, creating an optical mixing effect that gives the viewer a dynamic visual experience when viewed from afar. However, when viewed up close, these paintings may be seen to consist of intricate layers of individual colours, creating a profound interplay between clarity and ambiguity, detail and naturalness.



On the other hand, video games, which are designed specifically for entertainment, provide a powerful interactive medium that promotes creativity, increases adaptability, and builds problem-solving and language skills. Psychological research highlights the potential for video games to improve mood, reduce stress, and provide therapeutic benefits such as lowering the heart rate and promoting relaxation. Video games have been used as a therapeutic tool for over a decade to help relieve anxiety and improve mental health outcomes (Geico, 2022). The concept of “success” in gaming also increases players’ motivation and engagement, with overcoming challenges providing a sense of accomplishment. This “success cycle” keeps players immersed, allowing them to escape into an alternative reality that rewards effort, skill, and creativity.

Bringing Impressionism to a 3D game environment in Unreal Engine 5 offers a unique opportunity to enhance the experiential quality of both the art style and the game medium. Within an Impressionist-inspired virtual world, players will encounter beautiful natural scenes filled with intense colours and shifting light, similar to the aesthetics seen in classical Impressionist paintings. Using Unreal Engine’s advanced lighting and rendering capabilities, it is possible to simulate the surreal light effects seen in the works of Monet or Renoir, creating the atmosphere of a misty morning, a golden sunset, or a sparkling reflection. The game environment will feature multiple times of day, changing weather conditions, and realistic environmental interactions, reflecting the Impressionism’s emphasis on capturing different moods and moments in nature.

The gameplay design allows players to interactively explore these environments, allowing them to move around, discover hidden details, and perceive the colours and textures of the scenes up close, similar to viewing an Impressionist painting. Each scene is created with an emphasis on layering and depth of colour, providing varying perspectives depending on the player’s distance and perspective, mimicking the brushstroke effects and “cracking” techniques of Impressionist art. Through exploration, players may encounter environmental sounds, historical narratives, or poetic reflections on life and nature, allowing them to engage in an Impressionist-inspired experience that blurs the lines between art and reality.

This project’s objective transcends traditional gaming by merging Impressionist aesthetics with interactive digital environments. By positioning the player as an active participant rather than a passive observer, the game promotes not only entertainment but also cultural and educational engagement. Players will interpret art through their own choices and actions within the game, creating a personalized connection to the art movement’s principles. This type of immersive experience reimagines how historical art movements can be integrated with modern technology, providing a unique avenue for cultural appreciation and art education in an interactive format. It invites players to not only engage with the art but also to interpret it, fostering a deeper appreciation for Impressionism’s exploration of fleeting beauty, human emotion, and the ephemeral nature of existence.

## Methods and Materials

The design of a 3D Game Based on Impressionist Art: The Colours of the Knight, aims to create a game that combines the immersive qualities of 3D gaming with the aesthetic and technical characteristics of Impressionist art. The project explores how elements of Impressionism—particularly its distinctive use of colour, light, and brushstroke techniques—can be adapted into a digital game format to create an interactive experience that simultaneously functions as an artistic expression. By doing so, this study seeks to establish a new paradigm in game design that integrates historical art styles, enabling players to engage with and interpret Impressionist art in a novel, interactive way.



The research is organized into three structured phases to ensure a clear and systematic approach to achieving the project's objectives, enhancing both the researcher's comprehension and providing a framework for others who may study or develop similar concepts. Each phase builds upon the preceding one, forming a cohesive process that aligns with the goals of integrating Impressionist principles into game design:

### Phase 1: In-Depth Study of Impressionism

In the first phase, the research focuses on the foundational principles of Impressionism, which emerged in the late 19th century as a movement that aimed to capture the transient effects of light and colour in a naturalistic yet expressive style. This phase involves a detailed examination of Impressionist techniques, such as rapid brushstrokes, vibrant and unmixed colours, and atmospheric lighting. These elements will inform the visual style and artistic direction of the game. Resources include art historical texts, analyses of Impressionist work by artists like Monet, Renoir, and Degas, and studies on how these artists depicted movement, time of day, and emotional tone in their landscapes and figures (as shown in Figure 1). The goal of this phase is to distill the essence of Impressionism into game-ready concepts, identifying the visual and atmospheric techniques that can be adapted into a digital format to evoke the Impressionist experience. Establishing connections involves taking content within a specific scope and further developing it in terms of content and plot structure. This process includes generating new interpretations of key issues or intriguing problems, which are then listed to assist in structuring the narrative framework. By identifying and expanding on these connections, a more nuanced and coherent storyline can be developed, allowing for a deeper exploration of the themes and facilitating a fresh perspective on the topic at hand.

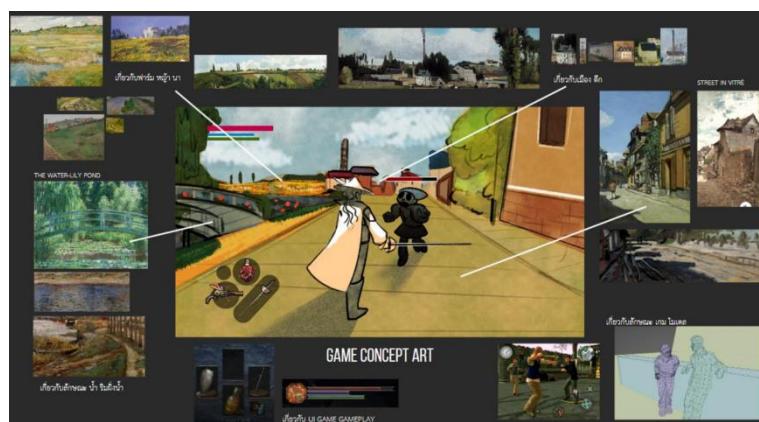


Figure 1 Game Conceptual Art

Identifying key themes that can be adapted to fit the characteristics of the chosen medium, creating conditions for problem-solving while considering the qualities of Impressionist art. This involves tailoring elements to reflect the movement's emphasis on light, colour, and atmosphere, allowing the medium to convey these qualities effectively. Through this approach, solutions are crafted to align with the Impressionist style, addressing challenges in a way that preserves the aesthetic and emotional essence of the art form.

### Phase 2: Design of Game Elements – Characters, Enemies, Environments, and Objects

The design scope for this project, intended for further application and adaptation, includes the following elements necessary for initial game development:

*3D Character Models:* A total of four characters model, including the player character and three boss characters.



**Boss and Enemy Animations:** Ten distinct animations covering idle, walking, and attack motions for both bosses and regular enemies.

**3D Item Models:** Four unique 3D item models.

**3D Environment Models:** Three distinct 3D scenes, totaling 24 assets for the game world.

**Puzzle Mechanisms:** Three types of puzzles to advance through levels.

**Player Animations:** Ten animations for the player character, including walking, idle, running, turning, jumping special attack, and standard attack moves (Figure 2).

**Cutscene Animations:** Four additional animations triggered during cutscenes, specifically for actions involving the acquisition of special abilities.

This design framework outlines the foundational assets and mechanics for the game, providing a clear and comprehensive structure to guide initial development efforts.



**Figure 2** Player Character Conceptual Design

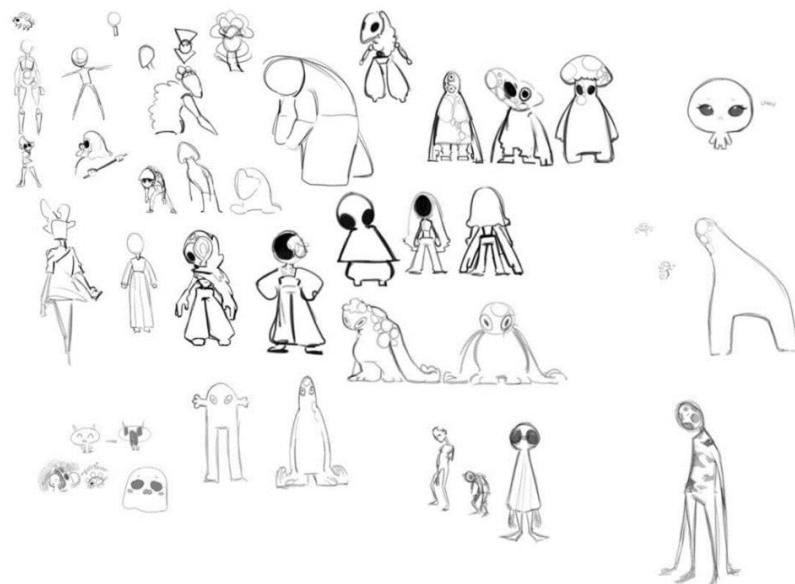
**Characters:** The player character and supporting figures are designed with an Impressionist influence in their colour schemes, textures, and visual details. Techniques such as layering colours and mimicking brushstrokes are explored to create characters that feel painterly, almost as if stepping out from an Impressionist canvas. The player should consider the character's weapon style and distinctive features to ensure they are memorable, iconic and instantly recognizable as part of the game. Drawing inspiration from the birth period of Impressionism, the character design can incorporate the style of a musketeer wielding a one-handed sword, blending this historical influence with an artistic flair. To add depth and personality, character traits should be inspired by attributes typically associated with their profession, making them more relatable and engaging (as shown in Figure 3).



### Figure 3 Player Character Design

The weapon design should reflect the character's role and profession, aligning with the artistic theme. For instance, the sword could be modified to resemble a paintbrush, and palette which could be incorporated, reinforcing the Impressionist-inspired aesthetic and creating a unique and cohesive design that ties directly to the game's artistic identity.

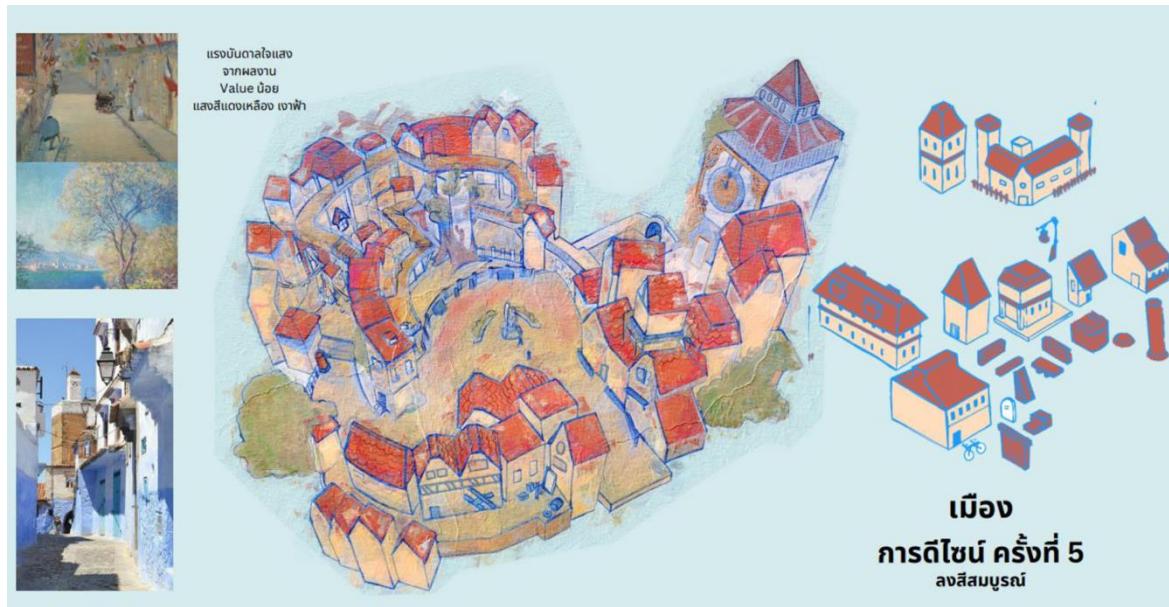
**Enemies:** Enemy characters are similarly crafted to fit within this art style, with their appearances contributing to the game's atmosphere. Each enemy type is designed not only for functional gameplay purposes but also as an extension of the game's artistic direction, ensuring cohesion in visual style and gameplay interaction. The design will encompass three distinct enemy types, each corresponding to different levels of difficulty to progressively increase the game's challenge. For the enemy design, research on art preservation methods will serve as a basis, with common threats to paintings, such as rodents, insects, and mould, reimagined as antagonistic entities within the game. These creatures symbolize natural decay processes and threats to artworks, transforming them into dynamic obstacles for the player. Each enemy type will embody unique behaviours and visual elements to align with its real-world counterpart, adding depth to the game's theme and creating a layered challenge that reflects the hazards faced by Impressionist art over time (as shown in Figure 4).



**Figure 4** Enemies Character Design



**Environment and Objects:** The game world is populated with Impressionist-inspired landscapes, such as sun-dappled forests, foggy lakes, and vibrant cityscapes. Objects within the environment, including interactive elements, are crafted to maintain visual harmony, employing Impressionist colour theory and lighting techniques to establish a cohesive world. Each location in the game reflects the dynamic qualities of light and colour as found in Impressionist works, with attention to detail that brings an immersive, atmospheric quality to the gameplay experience. The selection of locations for the game is designed to align with the era of Impressionist art, focusing on European-style homes and outdoor scenes that capture the interplay of sunlight. These environments reflect the characteristic settings of Impressionist works, as artists frequently chose to create their masterpieces in natural light. By selecting open-air locations, the game evokes the same atmosphere that inspired Impressionist painters (as shown in Figure 5).

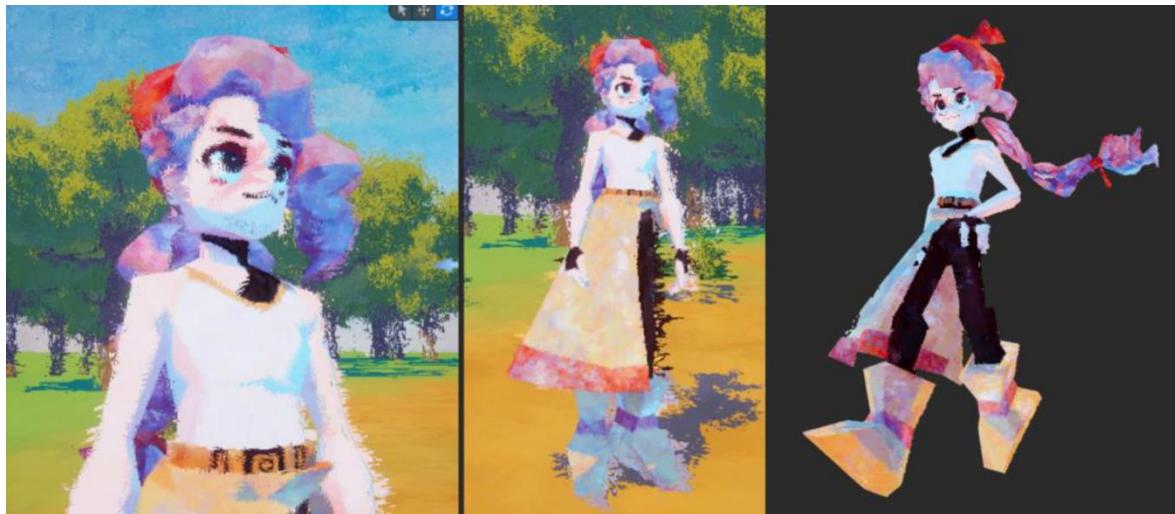


**Figure 5** Environment Game Design

In terms of colour palettes, the design will draw from paintings that closely resemble the desired aesthetic, using similar hues and techniques to create an immersive environment that reflects the vibrancy and luminosity of Impressionist art. The careful selection and application of these colours will enhance the visual authenticity of the game, ensuring that players feel transported to a world reminiscent of the Impressionist movement.

### Phase 3: Development of a Playable 3D Game Environment

The final phase involves implementing the designed elements within Unreal Engine 5 to create a functional and immersive 3D game environment. This phase is dedicated to achieving playability, ensuring that the game mechanics and visual effects accurately reflect the Impressionist style while providing an engaging player experience. Techniques employed include:



**Figure 6** 3D Player in Game Environment

**Lighting and Rendering:** Advanced lighting and post-processing effects are used to simulate the effects of natural light at various times of day, replicating the shifting colour palettes characteristic of Impressionist works. Real-time rendering capabilities in Unreal Engine allow for nuanced colour gradations and dynamic lighting that enhance the Impressionist aesthetic (as shown in Figure 6).

**Gameplay Mechanics:** Mechanics such as movement, exploration, and combat are designed to enhance the player's interaction with the art-inspired environment. Combat sequences incorporate visual effects that echo the movement and spontaneity of Impressionist brushstrokes, while exploration is encouraged through environmental storytelling, where players uncover narratives embedded within the landscape.

**Atmospheric Elements:** The game's atmosphere is reinforced by environmental sounds, weather changes, and day-night cycles, all contributing to a sensory experience that brings the Impressionist vision to life. This combination of interactive elements and immersive design serves to heighten the player's engagement with the Impressionist-inspired world, encouraging interpretation and emotional connection with the game's visual and thematic components.

## Results

The research project, 3D Game Design Based on Impressionist Art: The Colours of the Knight, has yielded results organized into four main phases, each essential to the development and implementation of the game:

### 1. Results from the Study of Impressionist Art

The study focused on the Impressionist movement, which marked a shift from traditional art with its rapid brushstrokes and avoidance of dark or muddy colours. Impressionist artists preferred working outdoors to capture natural light, resulting in works that depicted everyday life, atmospheric scenes, objects, and beloved individuals with a realism infused with subjective emotion. The study provided insights into how these techniques could be expanded upon within a 3D game world. Inspired by frequently depicted settings in Impressionist art, such as flower gardens, ponds, towns, and fields, the research focused on reimagining these locations to create an immersive, explorable world in the game.



## 2. Results of Character, Item, and Environment Design

Character designs include the player character and three enemy types, alongside items and environments, all modeled in 3D using Blender. These models were textured in Substance Painter to add realistic details that align with the Impressionist aesthetic before being imported into Unreal Engine. The design process was divided into three main components:

*Player Character:* Modelled to reflect elements of the Impressionist era, including costume details inspired by the period's styles.

*Enemies:* Designed to represent threats that could “damage” the game world, similar to how pests, such as insects, mould, and rodents, can damage artwork.

*Environments and Items:* Modelled to match the natural, light-filled outdoor scenes popular in Impressionist art.

## 3. Results of Gameplay Design

The gameplay was structured to reflect the themes and visual qualities of Impressionism. Players interact with the environment and solve puzzles that connect with the artistic concepts of light, movement, and perception, bringing the Impressionist style into the mechanics of exploration and problem-solving.

## 4. Results of Cutscene Design

The cutscenes were carefully crafted to enhance the game’s narrative, using cinematic techniques to replicate the feel of Impressionist paintings in motion. These scenes highlight moments of discovery, character interactions, and the player’s progression, using colour, light, and texture in ways inspired by classic Impressionist works.

The cutscenes integrate visual themes derived from the Impressionist style, emphasizing realism in daily life and using fast, expressive visuals to capture emotional resonance. These sequences aim to translate the sensory experience of Impressionism into an interactive medium, making the game feel like a world in which players are surrounded by living paintings.

## Discussion

Designing a game often mirrors the journey through a classic RPG dungeon, where each step presents a new layer of complexity and challenge. From confronting towering boss battles to deciphering hidden puzzles, game development requires navigating uncharted territory, sometimes without a clear guide or map. But each of these challenges—no matter how frustrating—becomes an experience point, enhancing our skill set and preparing us to tackle even greater obstacles in the future.

### Foundations in Game Design

Laying a solid foundation by learning game design fundamentals is critical. Choosing courses that provide structured, easy-to-understand instruction tailored to the type of game we aim to create is especially valuable. Courses covering 3D modeling, animation, game mechanics, and level design in specific engines (like Unreal Engine or Unity) help to streamline the learning process. They allow us to grasp the essential tools and techniques needed to design, prototype, and test ideas efficiently. This foundation minimizes errors, improves workflow, and gives us confidence as we take on more intricate tasks.

### The Value of a Creative Feedback Loop

Having friends or colleagues who enjoy gaming is another invaluable asset. By exchanging ideas with others who share our passion, we gain fresh perspectives and innovative ideas that we might overlook on our own. Collaborating in this way enriches our vision and helps refine game elements, from level design and gameplay mechanics to visual



aesthetics. Feedback from friends who playtest early versions can highlight aspects like balance, difficulty, and player enjoyment, ensuring the final product is engaging and enjoyable. Moreover, sharing the journey with others provides emotional support, which is crucial for maintaining motivation.

### **Embracing the Journey of Growth and Problem-Solving**

Game development is often unpredictable, filled with moments of trial and error, yet this unpredictability is precisely what makes it so rewarding. Each problem encountered teaches us more about our tools, strategies, and even our creative instincts. Setting achievable milestones, learning continuously from both successes and setbacks, and celebrating small victories are essential parts of the process. Documenting our journey can help track progress, highlight growth, and offer valuable insights for future projects.

Ultimately, game design is about both persistence and a passion. While the development path may be full of obstacles and intense problem-solving, it is also a profound learning experience that refines our skills, encourages creative exploration, and fosters resilience. Embracing this journey—enjoying every challenge and growth opportunity it presents—transforms game development from just a goal-oriented task into a deeply fulfilling process that is as enriching as the final game itself.

## **Conclusion**

### **Unreal Engine Game Development Capabilities**

The study of Unreal Engine 5 for game development revealed several critical advantages, particularly in its graphical prowess. This engine leverages high-end lighting and shadow techniques, notably with its “Lumen” global illumination system and “Nanite” virtualized geometry technology, which facilitate realistic light interaction and detailed, high-quality assets without excessive memory usage. These features enable developers to create visually stunning environments that resonate with realism, from intricate character models to vast landscapes.

Another benefit lies in its cross-platform support. Unreal Engine 5 allows seamless adaptation of games across multiple platforms, such as PCs, consoles, and mobile devices, by optimizing performance for each platform individually. This multi-device compatibility enhances the game’s accessibility and reach, opening up potential for a wider audience. Additionally, Unreal Engine’s community-driven resources and a vast array of assets in the Unreal Marketplace allow developers to integrate pre-made models, textures, and scripts, accelerating the development process and ensuring consistency in quality.

A key component is its “Blueprint Visual Scripting” system, which offers an intuitive, code-free scripting experience. This system enables developers to design intricate game mechanics and event-driven gameplay without needing extensive programming skills. This functionality is invaluable for novice developers and smaller teams seeking to implement complex game features while conserving resources.

Unreal Engine 5’s licensing model is particularly advantageous for independent developers and small studios, as it allows free access to the engine until the game generates significant revenue. This revenue-sharing model with Epic Games opens up high-caliber development tools to budget-constrained creators, enabling them to produce polished, commercially competitive games.

The Unreal Engine ecosystem, therefore, combines advanced graphics, cross-platform compatibility, robust community support, and cost efficiency, positioning it as a leading option for developers interested in creating visually impactful and commercially viable games for a broad audience.



### **Study of Impressionist Art**

The Impressionist period was a transformative time in art, marked by a break from traditional artistic norms and techniques. Emerging in the late 19th century, this movement was shaped by notable social, political, and economic changes. Major historical events, such as the Franco-Prussian War, the fall of the Second Empire, and the establishment of the French Third Republic, influenced the collective mood and societal values, leading artists to explore themes that resonated with these shifts.

Impressionist artists embraced a departure from conventional studio environments, favoring outdoor locations to capture fleeting light, weather, and daily life with a fresh immediacy. They used rapid, expressive brushstrokes and avoided dark hues, especially black, which were commonly associated with earlier art periods. Instead, they opted for lighter, more vibrant palettes, representing life through an impression rather than a precise replication. This approach imbued their works with emotional depth, creating a snapshot of a moment that felt authentic and relatable.

Cultural and philosophical developments also informed the movement. Darwin's theory of evolution and rising existentialist ideas encouraged people to view humanity and nature through new perspectives, challenging traditional interpretations. The urbanization surge during this era provided both inspiration and social critique, as artists depicted industrialized landscapes, cities, and modern individuals within these evolving settings.

The Impressionist movement was shaped profoundly by the socio-political and scientific changes of its time. Artists responded to the upheaval with innovative styles that broke from rigid academic norms, celebrating the transient and the ordinary. Their techniques allowed them to document life in ways that resonated with a rapidly modernizing world, offering viewers a raw glimpse into the social landscapes of their day.

### **Three-Dimensional Game Design: "Palettes Knight"**

The concept of "Palettes Knight" integrates elements of Impressionism into its 3D game design, creating an immersive narrative where players engage in a quest to protect and preserve art. Inspired by the brushwork and tonal qualities of Impressionist works, the game's design presents unique settings—gardens, rivers, towns, and fields—that players explore as they seek out lost or damaged paintings. These settings draw players into a world informed by historical Impressionist pieces, blending artistic exploration with gameplay.

The level design features enemies, like mold and natural decay agents, that threaten the preserved art, adding depth to the game's combat and narrative. These "enemies" not only serve as antagonistic elements in the gameplay but also symbolize the real-world challenges in art conservation. By combating these forces, players indirectly learn the value of preservation and the delicate nature of artworks. Each level thus reinforces the game's underlying themes of appreciation and protection of cultural heritage, giving players a dual experience of learning and engaging action.

The colour palette is essential in mirroring the light, vibrant tones typical of the movement. Shades inspired by Monet's landscapes and Renoir's cityscapes are applied to environments and characters alike, creating an immersive visual style that reflects the warmth and vitality of Impressionism. In addition, each area in the game employs a unique visual atmosphere, depending on time of day and weather, which recalls the techniques used by Impressionists to depict light.



The design of characters, enemies, and levels in "Palettes Knight" not only provides players with a visual and narrative journey but also presents an educational opportunity, connecting them to Impressionism in an accessible, interactive way. By exploring these thoughtfully crafted environments, players gain a richer understanding of the artistic style, its techniques, and the historical context that shaped it.

In conclusion, "Palettes Knight" achieves a balanced blend of art and entertainment, making it an innovative approach to both gaming and art appreciation. It presents Impressionist art as more than an aesthetic, inviting players to experience it as a world that is visually captivating and rich in historical and cultural resonance.

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## **The Design of a Webcomic to Enhance Knowledge of Thai Cuisine during the Reign KINGRAMA and the Court Lady System in the Thai Royal Court**

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### **Abstract**

This study explores Thai cuisine during the reign of King Rama V and the 'court lady system' of the Thai royal court. The objective is to design an educational webcomic that tells the story of traditional Thai cuisine and the lifestyle of court ladies during this period, making it accessible and engaging for young readers. Inspired by the last generation of court ladies during King Rama V's reign, a time of cultural transformation, the webcomic combines historical narratives with interactive elements and short animations to enhance engagement. The study used a qualitative research methodology, starting with a literature review, interview and surveys to identify the target audience's preferences and expectations regarding historical content and webcomic design. Insights from these methods helped shape the concept of art, the storyline, and the interactive features of the webcomic. The target audience consisted of adolescents and young adults aged 16-30, selected through purposive sampling. The storyline follows Kaew, a young character newly introduced to court life in the royal kitchen, who guides readers through traditional Thai cuisine. Each chapter introduces a different dish, explaining its origins, ingredients, and preparation methods while highlighting the cultural aspects of that era. To enhance the experience, the webcomic incorporates interactive elements and short animations, making the content visually appealing and immersive. After the webcomic was developed, an assessment questionnaire was used to evaluate the design, audience engagement, and the effectiveness of knowledge transfer. Feedback showed that the interactive features were well-received, with most participants finding the short animations engaging and suitable for the storyline. Young readers expressed increased interest in learning about historical and cultural topics through this medium. The webcomic effectively promoted awareness of ancient Thai cuisine and the court lady system, encouraging a greater appreciation of Thai cultural heritage.

**Keywords:** Webcomic, Traditional Thai Food, King Rama V, Court Lady System  
Thai Royal Court



## Introduction

Thai cuisine is deeply intertwined with the nation's cultural identity, yet many people today lack a comprehensive understanding of its authentic origins. This is particularly true for royal Thai cuisine, which often seems distant and inaccessible to the general population. While dishes like Tom Yum Goong, Nam Phrik (chili paste), and Pad Thai are commonly introduced to tourists, many traditional recipes are fading into obscurity.

Ancient Thai cuisine is considered a vital cultural heritage, encompassing recipes passed down through generations (Supawat & Sisikka, 2021). Historically, meals were served in sets to offer a diverse selection, with dining being a communal experience. Each meal typically included Steamed rice, savory dishes, curry accompaniments, foreign-inspired side dishes, dipping accompaniments, soup accompaniments, and desserts (Suntaree Asawai, 2024). Recent transformations have been driven by modern conveniences that make food more accessible. As the population grows and food becomes easier to procure, practices emphasizing meticulous preparation have diminished. Traditional ingredients are often scarce, leading to substitutions and altered flavors to cater to international tastes. This shift has contributed to the gradual loss of authentic Thai flavors. The rise of fast food has led to a decline in traditional dishes, which are often labor-intensive. This has resulted in many traditional recipes being forgotten.

Print media has also been affected by technological advancements. Social media now holds significant sway over younger generations, with digital content replacing traditional print formats. Despite these changes, print media is evolving rather than disappearing entirely.

To ensure traditional Thai cuisine remains part of Thai culture, it is crucial to make royal Thai cuisine more accessible. One promising approach is delivering this cultural heritage through webcomics—a format favored by younger generations—making it easier to understand and appreciate. This strategy aligns with the need for adaptation in an era dominated by mobile screen consumption, ensuring that cultural heritage remains relevant and engaging for future generations.

## Methods and Materials

This study aims to introduce royal Thai cuisine to younger generations and highlight the role of court ladies—who were among the last individuals to experience authentic royal cuisine—through the medium of webcomics. The progression of the study was structured into three distinct phases:

### Phase 1: Literature Review and Concept Development

In this initial phase, a comprehensive review of the relevant literature and documents was conducted to inform the development of compelling content, storyline, and concept art for the webcomic. Key areas of study included literature on royal Thai cuisine, documents pertaining to the hierarchy within the Thai royal court, preferences and characteristics of webcomic readers in Thailand, and studies on webcomic production and concept art design. This collected information served as the foundation for establishing the overall theme, storyline, and character designs of the webcomic.



## Phase 2: Webcomic Design and Development

Building on the conceptual groundwork established in Phase 1, the webcomic and associated concept art were designed following the guidelines of the Comic Creation and Consulting Institute (n.d.). The design process encompassed several key stages:

- 2.1 *Scriptwriting*: Crafting the script to detail plot, dialogue, and action sequences.
- 2.2 *Character Creation and Concept Art*: Designing characters and initial concept art to establish their appearance and personality.
- 2.3 *Artboards and Sketching*: Developing rough sketches and artboards to plan the visual layout of each scene.
- 2.4 *Layout and Paneling*: Structuring the layout of panels to guide the narrative flow.
- 2.5 *Lettering and Colouring*: Adding text elements (dialogue, narration, and sound effects) and applying colour to enhance visual engagement.
- 2.6 *Project Finalisation*: Refining and finalizing details in the webcomic prior to publication.

## Phase 3: Evaluation of the Webcomic

The final phase aimed to evaluate the comprehension and engagement levels of the target audience regarding the webcomic and concept art. Specifically, the objective was to assess how well the audience understood the design elements and whether they found the content compelling. The research employed questionnaires to assess the effectiveness of the webcomic in conveying knowledge of Thai cuisine during the reign of King Rama V and insights into the court lady system within the royal court. To ensure content validity, the questionnaire items were evaluated using the Item-Objective Congruence (IOC) method, reviewed by a panel of three experts. Feedback from these experts was incorporated to enhance the clarity and alignment of the questionnaire items with the research objectives.

### Data Collection

In Phase 1, secondary data was gathered from various literature on Thai royal cuisine, the court lady system, and webcomic production to support storyline and concept development. In Phase 2, feedback from a panel of art and design experts, who are lecturers in the Faculty of Architecture, Art, and Design at Naresuan University, was used to refine the initial script, concept art, and design. In Phase 3, an online questionnaire was distributed to adolescents and young adults (aged 16-30) to assess comprehension, engagement, and audience satisfaction of the webcomic.

### Data Analysis

The data analysis process employed two primary approaches. First, data gathered from the literature review and expert feedback was analyzed through content analysis. Key themes were identified and subsequently deconstructed to develop a structured framework for the webcomic, aimed at facilitating learning about Thai cuisine and the court lady system. Second, data from the webcomic evaluation was analyzed using descriptive statistics, specifically percentages, to assess audience comprehension and engagement.

## Results

Based on the literature review, the study results of webcomic reader behavior, and the design and development of webcomics with design experts, the research result can be summarized into the following design steps:



## Concept of Webcomics

The concept of the webcomic "Kroon Klin Plai Ja Wak," which translates to "The Aroma of a Lady's Delicacies," aims to evoke the essence of traditional Thai cuisine prepared by court ladies. The mood and tone of the webcomic conveys a sense of tradition and elegance, consistent with the historical theme. The art style integrates traditional Thai illustrations with modern webcomic aesthetics to enhance relatability for younger audiences. The use of vibrant and warm colours reflects the cultural richness of Thai heritage and the inviting nature of its cuisine, aiming to engage and educate the target audience effectively. Additionally, interactive elements and short animations are integrated to capture attention and enhance both knowledge and reader engagement.

## Storyline

The story revolves around "Kaew," a spirited and mischievous young girl who stands out from her peers. Unlike other girls her age, she shows little interest in learning household chores. Her father, worried that her unruly behavior might lead to future troubles and make it difficult for her to fit into society, decides to take action. He sends his only daughter to serve as a lady-in-waiting in the royal palace, hoping she will learn proper etiquette, household skills, and literacy ("Ancient Tradition of 'Offering Oneself in the Royal Court'", 2016). Kaew is placed under the care of "Princess Champha," who is her aunt. Thus begins the journey of this 12-year-old girl within the palace walls.

## Character Design

The concept art features main and supporting characters, all ladies-in-waiting during King Rama V's reign. Their attire reflects a blend of traditional Thai clothing and Western influences, typical of this transitional era (Sukhothai Thammathirat Open University Library, 2019). Ceremonial and daily outfits were designed to align with historical accuracy while showcasing diverse roles in the royal kitchen. The protagonist, "Kaew," wears distinct clothing that represents her personality and position within the storyline. The colour palette differentiates characters—vibrant colours for youthful key figures and muted tones for older, secondary roles—to enhance narrative engagement and visual storytelling.



**Figure 1** Character design



## Webcomic Design

The webcomic layout is presented in a vertical format, optimized for scrolling on mobile devices, which is a popular method today due to its convenience and suitability for quick reading. This approach is particularly appealing to those with limited time, offering easily digestible entertainment as seen in Figure 2.



**Figure 2** Webcomic Layout on devices

The webcomic consists of five episodes, each ranging from 10 to 15 pages in length. This length was chosen to ensure that each episode is neither too short nor overly lengthy, which could potentially discourage readers from continuing. The webcomic, titled The Aroma of a Lady's Delicacy. The story follows the journey of the main character from her initial introduction to the palace to her daily life and problem-solving experiences as seen in Figure 3. Throughout the storyline, the webcomic incorporates cultural insights, including knowledge about traditional Thai cuisine, rare recipes, and the experiences of court ladies within the royal palace as seen in Figure 4.



**Figure 3** Episode 1 of the Webcomic: The First Step into the Grand Palace



**Figure 4** Knowledge about traditional Thai cuisine

## Interactive Features and Short Animation

Interactive features for webcomics are typically designed to be simple and straightforward while enhancing the overall appeal and reader engagement. Since readers of webcomics often have limited time, the content must be easy to consume and entertaining. Examples of interactive features include background music that plays while reading to create an immersive atmosphere, short-animated clips to attract reader attention periodically, and screen interactions that trigger animations, allowing readers to feel actively involved in the storyline.

## Lettering

The webcomic's title, "Kroon Klin Plai Cha Wak," uses an elegant, intricate font called "DM Enchantia," which conveys a sense of tradition and elegance, aligning well with the historical theme of Thai royal cuisine. Different colour variations—gold, pink, blue, and white—are used to evoke various emotions and provide visual variety while maintaining a consistent traditional aesthetic as seen in Figure 5.



**Figure 5** Lettering



### Concept Art Book Design

The concept art book for the webcomic is formatted as an 11x8-inch hardbound book with a stitched spine. The interior pages are printed on glossy art paper, totaling 42 pages. The content includes a summary of all five episodes of the webcomic, as well as detailed descriptions of the design process, including the creation of symbols, characters, settings, and atmosphere. The book also covers the stages of developing the webcomic, from sketching to final colouring.



**Figure 6** Concept Art Book

### Webcomic Evaluation

The survey results indicate that the majority of webcomic readers are aged between 21-30 years (63.6%), followed by those aged 16-20 years (27.3%), with a smaller group aged 10-15 years (9.1%). In terms of occupation, over half of the respondents are students (54.5%), with a notable portion consisting of working professionals (27.3%). Regarding genre preferences, romance fantasy is the most popular (54.5%), followed by LGBTQ+/Y (45.5%) and historical genres (36.4%). Other genres such as action, reverse harem, and adventure are favored by 36.4% of readers.

Concerning opinions on the webcomic, most respondents agreed that the panel layout and pacing were appropriate and easy to comprehend. The chosen art style was also considered fitting for the story, and the depiction of characters' emotions received positive feedback overall. However, some participants found the sequencing of dialogues and captions slightly challenging to follow. Recommendations were made to enhance the visual storytelling to ensure better audience engagement, though the response to the content remained largely favorable.

Feedback on the interactive features showed that participants felt the elements complemented the storyline well, with many votes as "most appropriate." The background music was also seen as fitting for the narrative. However, opinions were mixed regarding the quantity of interactive features and whether they effectively enhanced the storyline. Responses varied from "somewhat appropriate" to "least appropriate," indicating an opportunity to optimize the use of interactive elements for better story integration. In terms of educational value, the webcomic was highly effective in enhancing knowledge about traditional Thai cuisine and the role of court ladies, suggesting a strong positive response towards its educational content.

Additional feedback highlighted that many readers found the storyline both entertaining and informative. Suggestions for improvements included reducing repetitive or complex language, providing more detailed cooking scenes, and expanding the number of episodes to allow for more character development. The feedback also underscored the



importance of making the content easily accessible, enriching cultural knowledge, and expanding specific aspects of the story to enhance reader engagement. Overall, readers expressed high interest in the webcomic's potential to delve deeper into royal Thai culinary traditions and court life.

## Discussion

The objective of this study was to explore royal Thai cuisine during the reign of King Rama V, to examine the court lady system in the Thai royal court, and to share this knowledge with younger generations through a webcomic as the internet allows for broader distribution and audience engagement, enabling creators to reach diverse demographics and explore new narrative forms (Horton, 2008). The research involved studying the origins and definitions of webcomics to gain an in-depth understanding and create a webcomic that would effectively engage readers. Key components included creating captivating characters, establishing a compelling storyline and themes, designing an appropriate visual style as suggested by Hihara (2016), and ensuring that each episode's length was neither too short nor too long to maintain reader interest. Additionally, the researcher investigated Thai cuisine and the court lady system during the reign of King Rama V, which are central to this study.

Regarding attire during the reign of King Rama V, the clothing style evolved to incorporate elements of Western fashion, resulting in modest outfits for both men and women. A new cultural norm was also established, encouraging women to grow their hair long and keep it neatly styled, as opposed to their previous short hairstyles. In terms of cuisine, there were influences from neighboring countries and foreign traders (Pullphothong, 2013). For instance, Khao Chae (rice soaked in jasmine-scented water) was adopted from the Mon people, and ice was imported from Western countries, becoming popular among the nobility for cooling purposes, eventually leading to the establishment of the first ice factory in Thailand. Certain dishes of royal Thai cuisine are rare today, as some have not been passed down outside of historical cookbooks. Examples include Khao Pad Man Goong Song See (Two-Color Prawn Fat Fried Rice), Goong Nam Chan (Moonlight Prawn), and Goong Bencharong (Five-Colored Prawn). These dishes often require meticulous preparation and a significant amount of time, leading to their gradual disappearance.

The study also revealed that the reign of King Rama V was the last period during which the existence of court ladies was mentioned, as the practice was abolished during the reign of King Rama VI. Court ladies in the royal palace were primarily from noble families and were sent to learn the customs and etiquette of royal women. Some families also sent their daughters to create connections within the court. The court ladies in each palace residence had distinct roles and abilities, depending on the royal figure they served. The researcher used these differences to inform character design, creating unique traits for each palace residence, thereby enhancing the narrative's overall appeal.

After reviewing the webcomic and concept art, the target audience expressed interest in the techniques used and appreciated the art style, noting that it was nearly comparable to those of well-known webcomics. This made the audience more interested in continuing to read the story. The interactive elements were found to be enjoyable, similar to findings by Shelton (2014); however, some readers were unaware that they could tap certain elements to activate the interactive features, as cautioned by Sayilgan (2023). Regarding their understanding of royal Thai cuisine and the court lady system, readers showed interest and a willingness to learn more about these topics through the webcomic.



## Conclusion and Suggestions

The design of the webcomic to enhance knowledge of Thai cuisine during the reign of King Rama V and the court lady system in the Thai royal court has been reviewed and approved by experts, leading to its development and dissemination. The project involves the design of a webcomic and a 42-page concept art book that aims to introduce royal Thai cuisine and the lives of court ladies to younger generations who are unfamiliar with these subjects. By presenting this content through the medium of a webcomic, the researcher aims to promote royal Thai cuisine and the court lady system as a form of "soft power" or cultural influence. This approach seeks to deepen the understanding of these cultural elements, which have often been superficially presented in mainstream media.

The storyline of the webcomic *Aroma of the Royal Kitchen* focuses on characters newly introduced to the role of court ladies in the royal palace, allowing the target audience to explore royal Thai cuisine and the life of the court ladies alongside the main characters. The narrative takes place within the residence of a high-ranking consort, who oversees the royal kitchen, with the protagonist learning and developing through the challenges she faces. Feedback from the target audience, gathered after the release, highlighted that the emphasis on the cuisine—the primary focus of the study—was somewhat overshadowed by the secondary storyline of the court ladies' lives. This reduced the effectiveness of conveying knowledge about Thai cuisine during the reign of King Rama V, which was not as impactful as initially intended. Readers expressed a desire to see more detailed depictions of the characters actually cooking, rather than just illustrated descriptions, to enhance the visual appeal. Furthermore, improvements in storytelling, language usage, and the sequencing of events were suggested to make the narrative more compelling and comprehensible.

Future research could focus on evaluating the effectiveness of various interactive elements in maintaining engagement and facilitating knowledge retention. A larger, more diverse sample size would also help to validate the findings and ensure that the webcomic appeals to different demographics beyond the initial target group. Moreover, comparing the impact of webcomics with other digital educational tools, such as games or interactive videos, would provide a clearer understanding of how webcomics can best serve as educational resources.

## Acknowledgments

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## From Global Waste Crisis to a Guide for Jewellery Design Using Bio-Circular Green (BCG) Economy

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### Abstract

Today's world is full of man-made waste, leading to a great impact on the environment and people's livelihood. Many businesses around the world have realized the environmental impact, including the gem and jewellery industry. They have adopted the concept of a circular economy system, which belongs to the holistic economic development model, or the BCG Model, as a solution to solve environmental problems, considering the use of resources to achieve the most value and longest possible time. Those consist of full product utilization, recycling, and designing products and manufacturing processes to reduce waste using the 9R strategy as a guideline. In Thailand, there are jewellery manufacturers who care about the environment and operate in accordance with the principles of the circular economy concept. This can be used as a guideline to create jewellery that reduces negative impacts and is environmentally friendly, leading to sustainable development. This also includes cooperation from the private sector and promotion of environmental policies by the government. This also includes cooperation from the private sector, promotion of environmental policies from the government sector, and consumers who are part of strict policies in supporting environmentally friendly products.

**Keywords:** Waste Crisis, Bio-Circular Green (BCG) Economy, Jewellery Design

### Introduction

Each year, the world generates municipal solid waste (MSW), including waste from companies, buildings, homes, and small businesses with the nearly amount of two billion tons. The volume of waste produced continues to increase with the growing global population. Furthermore, waste is expected to increase by 70% from 2016 to 2050 (Buchholz, 2022). The waste problem in Thailand is becoming increasingly severe, especially the issue of waste lingering in the environment. According to a report by the Pollution Control Department, Ministry of Natural Resources and Environment (2024), in 2023, the amount of municipal solid waste generated was 26.95 million tons, an increase of 5% from 2022 (25.7 million tons). It was found that 7.47 million tons, or 27.7%, of this waste was not properly disposed of. Waste management practices such as dumping waste in landfills, using small incinerators, or open burning produce greenhouse gases, all of which directly impact the ecosystem. Thus, global waste has become one of the environmental issues of utmost importance worldwide. The daily volume of waste generated on Earth is so immense that it cannot be disposed of, destroyed, or decomposed by natural methods, leading to significant environmental and natural resource issues and affecting the health of the global population.



From the global waste problem, the public has become aware of the resulting impact. The trend of social and environmental responsibility is becoming increasingly important in the purchasing decisions of the younger generation worldwide. Many industries are adapting and moving towards sustainable business development practices (Gem and Jewellery Information Centre, 2020). The gemstone and jewellery industry, is important for Thailand, as its export value, over the preceding years, has ranked third. It is also one of the top 10 export industries that generate the highest revenue for the country for decades. Nonetheless, currently, Thailand's gemstone and Jewellery production is facing a shortage of domestically produced raw materials, necessitating imports from abroad (Puey Ungphakorn Institute for Economic Research, 2020).

The concept of a Bio-Circular Green (BCG) Economy is an important alternative that many countries use to address environmental issues, focusing on the efficient use of resources under the new economic model, or BCG Model (National Science and Technology Development Agency (NSTDA), 2019). This concept can be applied to improve and develop production processes in the Jewellery and accessories industry, leading to the production and design of environmentally friendly jewellery that reduces environmental impact and ultimately achieves sustainability.

### **The gemstone and jewellery industry**

Jewellery serves to decorate the human body and has been a symbol of cherished memories for centuries. However, the beauty of traditional jewellery often comes with hidden costs. Therefore, large-scale mining and the processing of raw materials used in jewellery can significantly have an effect on the environment, from resource depletion and the release of harsh chemicals to pollution from manufacturing processes and greenhouse gas emissions. Nowadays, new innovations and the concept of sustainable jewellery are gaining attention and playing an important role in the jewellery industry, emphasizing environmentally friendly practices to achieve sustainability that is not just a trend.

The issues with traditional jewellery production that have an effect on the environment are found to have the following key points.

#### **1. Mining and the sourcing raw materials**

Gemstones and precious metals often come from large-scale mining operations, causing environmental damage, deforestation, soil erosion, and chemical contamination of water sources. Mining and the sourcing raw materials for gemstones and precious metals often originated from large-scale mines, causing environmental damage, deforestation, soil erosion, and the contamination of water sources.

#### **2. The use of chemicals in processing and finishing**

The production process often involves the use of hazardous chemicals, which cause water and air pollution, as well as other health hazards having an effect on workers in jewellery factories.

#### **3. Waste generation and disposal**

Traditional production creates a lot of waste of various kinds, from the initial production process through to the final consumer (Royi sal, 2024).

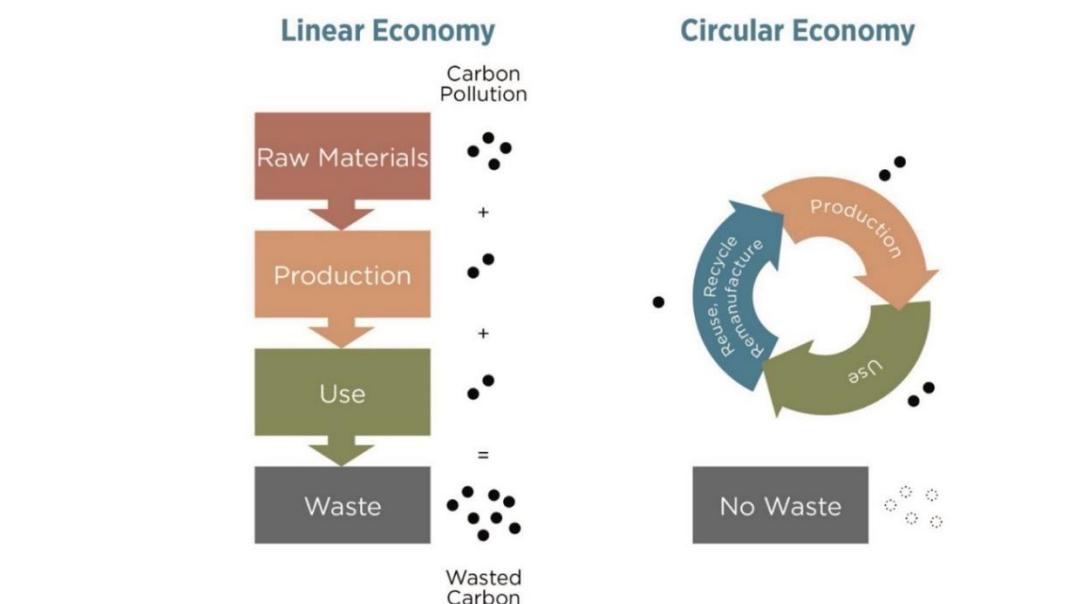
### **Circular economy**

Since the Industrial Revolution, the economy has been driven in a linear manner, which means resources are used in one direction through the production process, leading to usage and disposal (single-use products). This has resulted in massive amounts of waste, both from garbage and surplus goods, creating pollution and accumulating greenhouse gases at waste disposal sites. There has been no consideration for reusing waste, leading to resource shortages while the demand for resources has significantly increased. The European

Union has recognized the problem of resource scarcity from this situation and has designed an economy focused on maximizing resource use, reusing raw materials, and minimizing waste or by-products. This has led to a circular economy where waste or garbage from the system is minimized to zero waste (Thailand institute of scientific and technological research (TISTR), 2019). The comparison of the two systems is shown in Figure 1.

In driving the circular economy, there are three key principles (National Science and Technology Development Agency (NSTDA), 2019) as follows

1. Using the product throughout its entire life cycle by extending its lifespan.
2. Transformation for reuse through the recycling of raw materials and products
3. Designing products and production processes to minimize waste or garbage.



**Figure 1** Comparison of linear economy and circular economy

Source: LMN Architects, 2022

### Designing jewellery using the circular economy

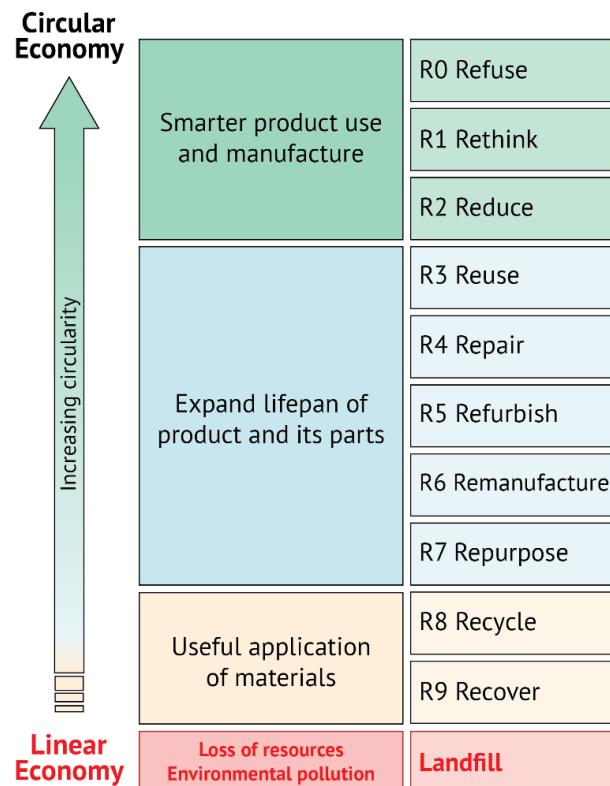
The Gem and Jewellery Information Center (2021) stated that in the jewellery and gemstone industry, circular economy models are being used. Currently, several global entrepreneurs and renowned brands operate under this concept, from the product design and development process to the production process. Traditionally, design was based primarily on the aesthetics of the jewellery and customer needs. These ornaments are often disposed of and later become waste. Nevertheless, sustainable design helps reduce the environmental impact of products by considering environmental friendliness from the sourcing of raw materials, controlling energy use in the production process, and minimizing waste or leftover materials. Packages made from materials that do not harm nature, and the final products can be reprocessed into new raw materials

### Strategies for circular economy

The concept of reducing waste and promoting the efficient use of resources, known as the 3R concept, has been popular for a long time. It consists of Reduce, which means using fewer resources; Reuse, which means using products again; and Recycle, which means processing waste materials for reuse. This concept has evolved into the 9R strategy for a circular economy to enhance efficiency and promote resource circulation in all aspects. The strategies for building a circular economy can be divided into three phases: 1) Design phase,

focusing on planning the use of raw materials and production processes wisely; 2) Usage or consumption phase, focusing on extending the lifespan of parts and products; and 3) End-of-life phase, focusing on maximizing the utility of waste materials. The strategies are ranked as follows: R0 Refuse is the strategy closest to a circular economy, while R9 Recover is at the end of the list as it is the method closest to a linear economy. Higher-ranked strategies create more positive impacts and sustainability (as shown in Figure 2). Accordingly, it can be said that R0 Refuse is the ideal strategy for a circular economy aimed at making the world free of waste or achieving zero waste. (Malooly and Daphne, 2023)

Therefore, the concept of using raw materials and production wisely from the very beginning of the design process, with the main strategies being R0 Refuse along with R1 Rethink and R2 Reduce, is significant in developing a circular economy. Producers should adhere to these principles as their main practices to create the best outcomes for the environment.



**Figure 2** 9R Strategies for circular economy  
Source: Adapted from Malooly and Daphne, 2023

### 9R Strategies

The principles of the 9R strategy (Malooly and Daphne, 2023) and guidelines for application in jewellery are as follows.

**R0 Refuse:** Not introducing new raw materials into the system, not using toxic raw materials, discontinuing hazardous production processes or ceasing the production of goods or products harmful to the environment. Switching to more environmentally friendly methods or processes, such as choosing alternative materials, discontinuing or controlling the use of materials and tools containing hazardous chemicals like mercury and cadmium.

**R1 Rethink:** Reconsidering the use of products by making them versatile or compatible with various other products. For example, designing jewellery to be useful beyond just decoration for beauty.



**R2 Reduce:** Reducing the use of natural resources or materials while increasing efficiency in both the production process and product usage, such as reducing unnecessary product parts or packaging, and using materials wisely.

**R3 Reuse:** The act of bringing back products that are still in good condition for use in their original form without undergoing the production process again, such as using parts of old jewellery together with new jewellery.

**R4 Repair:** Maintenance and repair of damaged products to keep them in good condition for long-term use instead of discarding them, such as designing jewellery to be easily maintainable.

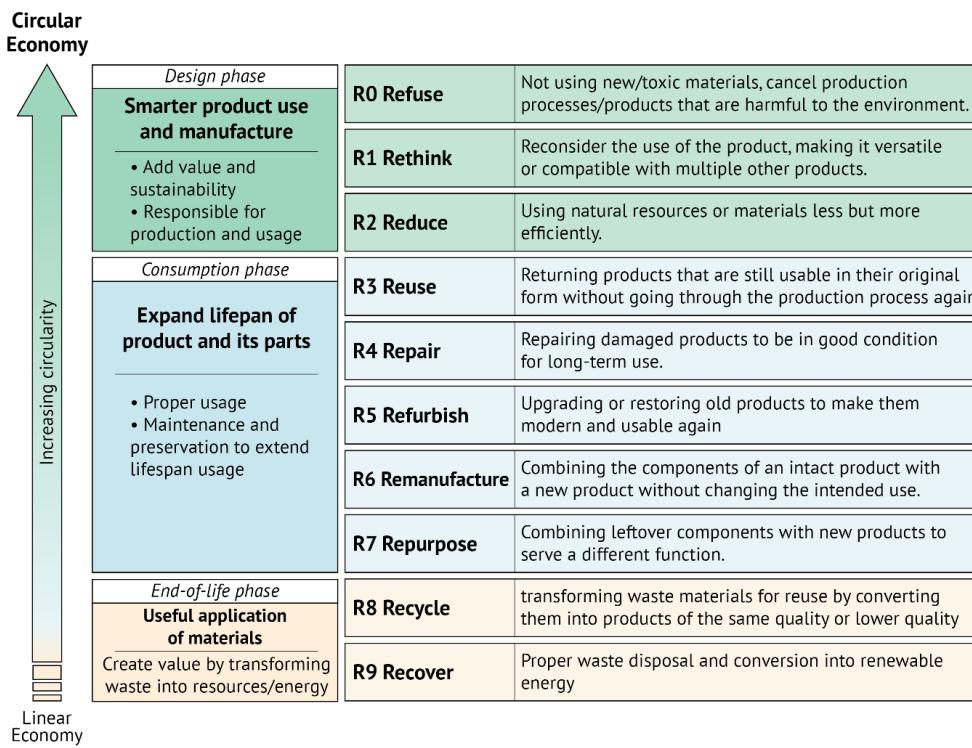
**R5 Refurbish:** The process of upgrading or restoring old products to make them modern and usable again, such as refurbishing old jewellery to look like new again.

**R6 Remanufacture:** The process of integrating intact components of a product with new products without changing the intended use of the product. For example, repurposing used parts or components of jewellery to restore them for their original use.

**R7 Repurpose:** The process of integrating leftover components with new products to serve a different purpose than originally intended. For example, using old parts or components of jewellery to create new jewellery that meets a different functional need.

**R8 Recycle:** The process of transforming waste materials for reuse by converting them into products of the same quality or lower quality (Downcycle). For example, taking damaged or worn-out materials or jewellery before disposal and processing them to create new products.

**R9 Recover:** The proper disposal of waste or garbage and its conversion into energy, such as promoting waste separation before disposal and sending waste for proper disposal.



**Figure 3** An overview of 9R Strategies  
Source: Adapted from Malooly and Daphne, 2023

However, the above strategies can be adapted to fit the surrounding context or follow the guidelines of each organization. Most of the time, it involves selecting multiple strategies simultaneously to achieve maximum efficiency.



### Jewellery in Thailand

Jewellery trends in Thailand are moving towards an eco-friendly concept, with a greater emphasis on environmentally conscious designs and development. This corresponds with the circular economy concept, as shown in the following examples of jewellery manufacturers with the above concept.

#### Pranda group

The Pranda Group are Thai jewellery and gemstone manufacturers committed to conducting business responsibly as a good member of our community, society, and world. They adhere to sustainable development practices that cover all dimensions, especially in the environmental aspect, setting a goal to achieve net-zero greenhouse gas emissions within the organization by the year 2050. They follow operational guidelines such as efficient energy management, water management, standardized waste and pollution management, and measures to reduce greenhouse gas emissions from the production process (Pranda group, 2023)



**Figure 4** Sustainable development from Panda Group

Source: Pranda group, 2023

#### Qualy brand

Qualy has a policy of conducting business in line with sustainable development, aiming to reduce environmental problems from the product design stage under the commitment and desire to take serious action. This requires cooperation with government agencies, business partners throughout the value chain, and consumers. This is done by using the potential of creativity, innovation, production, communication channels and trade channels to drive towards sustainable development goals (Qualy design, 2022). The brand's products focus on using waste materials, particularly through upcycling, which involves transforming waste or unused materials into valuable and useful items.

Creating jewellery works in collaboration with other brands such as Cherinadded and Jiira. Cherinadded blends cultural stories with functionality, using flower parts made from recycled plastic and ceramic pollen at the core, hand-painted by skilled artisans. The design is rich in stories and intricate details that reflect lifestyle and sustainability (Qualy, 2024a). Additionally, Jiira, elevates jewellery to become art pieces that incorporate the lifestyle of the Karen community. The piece named "Care Curve Cave" is inspired by the Mae Sa Cave in the Samoeng District of Chiang Mai Province, made from recycled plastic waste found in natural tourist areas (Qualy, 2024b).



**Figure 5** Jewellery from Qualy in collaboration with Cherinadded (left) and Jiira (right)

Source: Qualy, 2024a, 2024b

### Pipatchara brand

Pipatchara aims to be a fashion brand, therefore it aims to contribute to the community society and environment under the concept of sustainability. The design work "Infinitude" primarily uses orphan plastic waste such as plastic bottle caps yogurt drink bottles and plastic cutlery which constitute waste with no intrinsic market value. These materials are repurposed through the production process to create eye-catching pieces that are woven into clothing, bags, and accessories. The colours and patterns depend on the types of plastic mixed, resulting in unique characteristics for each piece. This embodies the meanings of Rebirth Recycle and Redone representing the concept of Infinitude (Room, 2022).



**Figure 6** Material and product from Pipatchara

Source: Room, 2022

### Sarr.rai brand

The alternative jewellery brand aims to create fun for consumers drive environmental initiatives and develop Thai craftsmanship. Its three key design principles are: 1) Organic form design to maintain the essence of craftsmanship 2) Using environmentally friendly materials such as silver metal and endlessly recyclable glass beads freshwater pearls from eco-friendly farms and upcycled glass bottles to showcase the beauty of materials that were once considered worthless waste and 3) Creating jewellery suitable for all genders and ages to convey environmental awareness (Chatchanok Chaiwong, 2024).



**Figure 7** jewellery from Sarr.rai  
Source: Chatchanok Chaiwong, 2024

### Benaglai brand

From the ancient Benjarong ceramics of Samut Songkhram province, Pinsuwan Benjarong has transformed them back into life through fashion accessories. By taking imperfect, substandard, flawed, or broken Benjarong pieces and creatively polishing them alongside silver, they become unique accessories, each piece distinct from the others. This presents an interesting new image, communicating Thai identity in a different and modern way (Sukontala Yaempiew, 2020).



**Figure 8** Jewellery from Benaglai  
Source: Sukontala Yaempiew, 2020

From the examples of jewellery manufacturers above, it can be seen that the principles of circular economy are being raised through the thinking process and planning. Production and disposal using innovative and environmentally conscious technologies throughout the product lifecycle results in waste or garbage being transformed into resources for producing jewellery and accessories that express their own beauty. These things not only have added value but are also environmentally friendly and create awareness in conserving resources in another way.



## Conclusion and Suggestions

Environmentally friendly jewellery aims to eliminate waste by utilizing resources within the system's cycle according to the circular economy approach. This includes using products throughout their entire life cycle transforming them for reusing and designing to minimize waste or by-products from the system. This practice should be accelerated, which requires support from the government to drive the 9R strategy. It is an important strategy to drive the circular economy, promote environmental conservation policies, and spread knowledge to communities. In addition, in the private sector, manufacturers, entrepreneurs and designers should apply the 9R strategy, considering designing and planning from the beginning of the product cycle, creating value-added products from circular materials. Meanwhile, they also raise awareness of the consequences, persuading consumers to pay more attention, give importance and choose to consume more environmentally friendly products. This is to jointly create a balance between humans and nature, which would finally lead to moving towards sustainable development.

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