

# From User Experience to Environmentally Sustainable Markets: Exploring the Sustainability Innovation of Cultural and Creative Market Mobile Interfaces

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**Abstract**—In recent years, the concept of achieving net-zero carbon emissions by 2050 and the trend of carbon border adjustment mechanisms in Europe and America have been advocated worldwide. Cultural and creative markets have already assumed a highly significant role in people's daily lives. Consequently, cultural and creative market activities also need to align with the concept of the “Net Zero Carbon Emission Wave.” By implementing net-zero carbon emission activities within small groups of cultural and creative markets, it becomes possible to achieve environmental sustainability.

Cultural and creative markets have often integrated festival events and historical heritage with sustainable environmental concepts. This approach attracts crowds, fostering a sense of local culture and enlivening the environment. Cultural and creative markets have become increasingly popular in Taiwan. These markets serve as friendly venues that combine art, handicrafts, niche brands, and local agricultural products.

This study employs the method of visualizing customer journey in service design. It utilizes semi-structured interviews, observations, and customer journey mapping to record data. Analysis is carried out using task time performance, the System Usability Scale (SUS), and the Questionnaire for User Interaction Satisfaction (QUIS). This approach leads to the formulation of prototype designs for two interface options, labeled as A and B. Relevant experts and scholars are invited to evaluate and provide suggestions. A comparative analysis of experimental tasks is also conducted for the two interface designs.

This study employs a user-participatory approach to involve users in the design and improvement process of the cultural and creative market interface. By integrating sustainability and perpetual concepts to enhance innovative models, the goal is to achieve a more appealing and user-friendly interface. Simultaneously, through a co-creative approach, users are engaged in the creation and design of the interface, thereby increasing their emotional investment in the design and fostering long-term engagement, ultimately leading to sustainable innovative energy. This fusion ensures the sustainable development of the cultural and creative market while also enabling it to generate positive impacts for users and the environment on various levels.

**Keywords**—cultural creative market, environmental sustainability, service design, user experience, user interface

## I. INTRODUCTION

In recent years, the concept of achieving net-zero carbon emissions by 2050 and the trend of carbon border adjustment mechanisms in Europe and America have been advocated worldwide. From corporate organizations to individual

workspaces, from state-owned industrial plants to personal cultural creative markets, the implementation of “Net Zero” mechanisms is necessary. The origin of this concept dates back to the 2015 Paris Agreement, in which countries committed to achieving net-zero emissions by 2050. In the context of local activities within cultural and creative markets, efforts can be directed towards reducing paper consumption, reusing wastepaper, and embracing digital transformation services. This can involve utilizing mobile digital services or app interfaces to align with the principles of environmental sustainability.

With the collaboration between the government and private sector in Taiwan, cultural and creative markets have become increasingly popular in the streets, alleys, and historical buildings of various cities and counties. These markets serve as platforms that blend commercial culture with artistic design. They encompass artistic and cultural elements, creative designs, handmade products, self-established brands, and local small-scale agriculture. This convergence of diverse creative elements allows for the participation of young creators and designers through exchange, providing them with a platform to pursue their dreams. In 2006, according to statistics from the National Youth Commission under the Executive Yuan, the cultural and creative industry entered the top three most influential industries among young people in Taiwan for the first time. Among these, self-established brands and unique marketing were considered by nearly 80% of young entrepreneurs surveyed as the most indispensable factors in the entrepreneurial process [1].

In cultural and creative markets, the majority of products sold are limited in production and handcrafted. These products are known for their intricacy and uniqueness, breaking away from the traditional mass production of commodities. As consumer preferences shift from merely seeking practicality and utility in their purchases, they increasingly value the service experience and the perceived worth during the product selection process [2]. Present-day industries often emphasize design thinking and interactive orientation as their primary service objectives. Speaking in terms of service design, sellers are no longer limited to physical stores, extending to industries such as fashion, dining, and retail. In the age of the internet, it becomes even more essential to establish new interactions and connections among consumers, stores, and products. Integrating online platforms

such as websites and apps can provide novel experiences for consumers, facilitating new ways of engagement and interaction.

#### *A. Motivation and Objectives*

Cultural creative markets serve as a channel for people to engage with, characterized by their unique environmental ambiance, cultural atmosphere, and commitment to environmental sustainability. These aspects set cultural creative markets apart. How do the environmental ambiance and the concept of environmental sustainability impact consumers' willingness to participate in these markets? Cultural creative markets often align with festive events, historical landmarks, and environmental sustainability initiatives to attract crowds, enhance purchasing capacity, and foster sustainable operational practices. The concept of an environmentally sustainable environment can be approached from various angles, but at its core, it signifies the necessity of balancing economic development with the preservation of the environment and social well-being. Consequently, cultural creative markets rely on sustainable environmental spaces, the integration of historical landmarks, and innovative operational methods, resulting in a win-win scenario. The approach to environmental sustainability acts as a vital bridge connecting cultural creative markets and consumers.

Cultural creative markets are inherently regional, with each market closely linked to the local environment, historical landmarks, and the principles of environmental sustainability. The fusion of cultural creative markets with models of environmental sustainability can give rise to various types of cultural creative clusters, such as linear cultural creative markets, clustered cultural creative markets, circular cultural creative markets, and networked cultural creative markets. These models exemplify the utilization of environmental spaces in distinct ways, all while being interwoven with the concepts of culture, creativity, and sustainable practices.

For the sustainable management of cultural creative markets, the primary conditions include the quality of the market itself, environmental sustainability, and the provision of excellent service quality and original products by creators. Consumers' experiences within cultural creative markets are influenced by both distant observations and direct interactions with services or products. This leads to a positive self-experience sentiment. Research also indicates that the increase in perceived value corresponds to the experience during the process [3].

This study focuses on "Small Snail Cultural Creative Market" and "Jiu Jiu Cultural Creative Market" as the primary subjects of service design. The study explores individuals (consumers, market vendors), resources (venues, social media), and processes (customer journey mapping) to identify areas of concern. Service experience is an ongoing process, and participants often find it challenging to distinctly segment their emotional responses to different elements within the experience. Therefore, this research aims to thoroughly investigate the overall service experience satisfaction of participants, specifically "consumers" and "market vendors," in these two major cultural creative markets.

## II. LITERATURE REVIEW

### *A. Cultural Creative Market*

The term "cultural and creative industries," abbreviated as "cultural and creative," was officially legislated in Taiwan on January 7, 2010. It serves as an essential indicator for fostering effective economic development [4, 5]. Similarly, the United Nations published the "Creative Economy Report 2010" during the Trade and Development Board meeting in 2011, highlighting that the design sector's commodities accounted for over 60% of global creative goods in terms of import and export trade [5]. This underscores the undeniable potential for the "cultural and creative industries" to contribute significantly to global and regional economic development. In Taiwan, the cultural and creative industries are regarded as a primary economic force in what is often referred to as the "Fourth Wave" of economic development.

At that time, the urban corner culture formed by the gathering of design creators in several important markets in the London area, this also marked the emergence of the term "creative markets" during that period [6]. A "market" involves the buying and selling of goods within a specific venue. The combination of "market" and "cultural and creative" refers to engaging in transactions and services related to cultural and creative activities within this venue [6]. For cultural and creative markets, the products they offer differ from regular markets or stores. These markets are typically set up in familiar settings such as streets, alleys, old breweries, former sugar factories, or even old military dependents' village dormitories. The platforms provided for market vendors are usually in the form of stall-style circulation and display platforms [7]. The products sold at these markets are not separated from consumers by barriers; instead, they showcase designer goods, handmade items, and even unique lifestyle products, emphasizing the infusion of fun and art into daily life.

### *B. Environmental Sustainability*

In recent years, climate change and global warming have become globally significant issues, posing threats to the Earth's environment and potentially impacting future generations. The Paris Agreement (NDC) and the Sustainable Development Goals have set forth relevant guidelines. Under the influence of factors such as climate change, global warming, and the COVID-19 pandemic, there has been a surge in regional business opportunities. [8]. To achieve environmental sustainability and sustainable operational concepts, developments ranging from the preservation of historical buildings to the revitalization and reuse of abandoned environmental spaces have emerged and are now actively promoted as cultural and creative markets worldwide [8, 9].

Cultural and creative markets inherently embody policies that yield economic benefits, while also fostering sustainability through design, art, and the construction of humanistic environments. Many of these markets are situated in regions with well-known landmarks or historical buildings, which carry rich historical and cultural significance [9]. This allows their public spaces to evolve into venues for cultural and creative markets, where the intertwining of culture and

creativity can establish a space that is sustainable for operation [9, 10].

Environmental sustainability is a global shared concept, and despite not being a new notion, ensuring the sustainable development of the environment and the preservation of historical landmarks is a responsibility that every individual holds. Business organizations and community groups should advocate for the concept of environmental sustainability, including engaging in green movement activities [10]. In a broad sense, environmental sustainability refers to ensuring the continuous supply of natural environmental resources over the long term, without compromising ecological balance and ecosystem functionality, to meet the needs of both present and future generations. It should also encompass promoting the value of renewable utilization of environmental resources, historical landmarks, architectural heritage, and green spaces.

Culture refers to the shared values, beliefs, traditions, customs, and arts of a community within human society. Culture is a vital component of human society and also influences our way of life and value systems [10, 11].

There is a close relationship between environmental sustainability and culture. On one hand, environmental sustainability needs to consider cultural diversity, ensuring that measures to protect the ecological environment do not harm the cultural values and traditions of specific communities. On the other hand, culture can also play a role in promoting environmental sustainability. For example, traditional ecological wisdom and sustainable lifestyles can offer valuable experiences and methods that help societies adapt to environmental changes and protect ecosystems more effectively. Therefore, the relationship between environmental sustainability and culture needs to be thoroughly considered and balanced in the formulation of policies, implementation of plans, and promotion of sustainable development. This approach ensures that while protecting the environment, various cultural heritage and values are also respected and preserved. [10–12]

The development of cultural and creative markets will embody the fusion of environmental protection and cultural heritage. Through displays, interactions, and education, it will encourage people's attention and participation in both environmental and cultural aspects. Such cultural and creative markets can become vibrant venues that showcase the integration of environmental sustainability and cultural creativity. For instance, they can feature environmentally sustainable products and green initiatives, revitalize historical spaces and heritage buildings for sustainable operation, and contribute to environmental education and advocacy [11, 12]. By combining the values of environmental sustainability with the regional characteristics of cultural and creative markets, these two aspects can mutually enrich each other, generating diverse values and enhancing the service experience.

Cultural and creative markets increasingly advocate for environmental sustainability, responding to global trends by raising awareness about environmental conservation [12]. They motivate individuals and groups to collectively practice actions that contribute to a more sustainable and environmentally friendly future.

### *C. Service Design*

“Service,” as defined by Wang Rongzu, refers to the provision of tangible or intangible goods or services to others within a specified time and space, resulting in an enhancement of value for those individuals. “Design,” on the other hand, entails effectively planning and adjusting concepts within a project with the user at the center [13]. The combination of “service” and “design” was first introduced in an article titled “Designing Services that Deliver” from the Harvard Business Review [14]. Subsequently, more scholars have proposed related definitions for the term “service design.” Moritz perceives service design as a holistic activity involving both service providers and recipients, forming a complete process through various touchpoints. This can elevate recipients' expectations and value through their experiences [13, 14].

Parker & Heapy argue that interactions between people and services, when combined with the current service state and refined new service approaches, can generate new service value [15]. Stickdorn & Schneider propose that service design primarily targets service recipients, offering them a well-planned and integrated design, whether tangible or intangible, to ensure a positive experience. Scholar defines service design as the effective planning and utilization of design values through engagement with internal and external stakeholders, facilitating the co-creation of a network that fosters interactive relationships and experiences [16]. This approach conveys the value proposition to service recipients and serves long-term strategic purposes.

The existence of service design not only brings forth more possibilities for current academia and industries, but also emphasizes the linkage between the sensory experiences of consumers and their overall service encounters, as highlighted [14–16]. This connection is crucial for clarifying consumers' firsthand experiences within service contexts. The user experience research organization, Nielsen Norman Group, breaks down “service design” into three key components: “people,” “props,” and “processes” [15, 16].

Morelli proposed three main objectives for accomplishing service design points:

- 1) Identify Participating Roles: Confirm the relevant roles involved in the overall service design to analyze and uncover process issues.
- 2) Develop and Validate Feasible Solutions: Develop feasible service directions and validate them using case studies to plan optimal sequences and gather relevant stakeholders, thereby determining service logic and organizational structure.
- 3) Propose and Elaborate New Service Concepts: Introduce new service concepts and explain all components and sequence of processes [17].

Stickdorn proposed five fundamental principles that service design should adhere to points:

- 1) User-Centered: Observe consumer interactions within the service process, as merely relying on literature or data cannot adequately comprehend consumer needs.
- 2) Co-Creative: Service design is a multidisciplinary field; it invites relevant stakeholders to collaboratively plan, discuss, and implement actions.
- 3) Sequencing: Every touchpoint in the service process

should be seamlessly connected, identifying the best service for consumers.

- 4) Evidencing: Transition intangible designs into tangible ones by invoking consumers' memories through physical items or evidence. Positive experiential memories can lead to feedback and loyalty upon recollection.
- 5) Holistic: Services are intangible yet executed in reality. Ensuring a cross-disciplinary and user-centered approach throughout the entire process brings the service closer to consumers, thereby achieving effectiveness [18].

Introducing the emerging academic discipline of service design into physical environments has resulted in a multitude of positive outcomes across various sectors, including the cultural and creative industries, dining, services, finance, healthcare, and sustainable operations [17, 18]. Scholars have emphasized that even when dealing with tangible goods, service design requires creating excellent customer experiences throughout the pre-purchase, during-purchase, and post-purchase phases. Service design focuses on whether customers' experiential perceptions before, during, and after a service have been enhanced or meet expectations. Effective service design emphasizes that from the customer's perspective, tangible products or virtual services must be useful, usable, and desirable. Furthermore, at the organizational level, it aims to provide efficient and reliable services [18].

#### D. User Experience

User Experience (UX) refers to the behaviors, emotions, or feelings of an individual or a group when interacting with a specific product, system, or service. According to the International Organization for Standardization ISO 9241-210, user experience also encompasses user preferences, habits, cognitive processes, emotional responses, and achievement of tasks (ISO 9241-210, 2010). The term "User Experience" was initially coined by Norman in 1995 and the first set of methods for quantifying UX was also established by him in the laboratory setting [19]. Gradually, an increasing number of experts, scholars, and even designers have been conducting research in the field of User Experience (UX).

Joel Marsh elaborates on five key components of researching User Experience (UX), as follows points: [19, 20]

- 1) Psychology: Designing UX often involves incorporating more ideas and emotions to empathize with users' interaction patterns.
- 2) Usability: When users are focused on interacting with the interface, usability testing provides reliable data.
- 3) Design: Designing UX revolves around making operations functional and aligned with users' objectives.
- 4) Copywriting: UX copywriting strives to be direct, simple, and clearly descriptive for users.
- 5) Analysis: Properly distinguishing UX from other designs is a primary factor for users to experience superior interactions, please see the Fig. 1.

Norman introduced three distinct concepts of mental models: the "designer's model," which represents how the designer envisions the product or interface; the "user's model," which pertains to the mental models' users develop while interacting with the product or interface; and the "system image," which serves as the bridge between the

designer and the user. In 1983, Norman identified six independent characteristics of mental models: [19, 20]

- 1) Incompleteness: Mental models unique to individuals are often incomplete with respect to the phenomenon.
- 2) Limitation: Users' ability to execute mental models is restricted to some extent.
- 3) Instability: Users' mental models are mostly dynamic, and prolonged disuse leads to forgetting finer details.
- 4) Inconsistency: Contents within mental models are typically inconsistent and lack distinct boundaries, often resulting in confusion for similar mental models.
- 5) Unscientific Nature: People often believe in mental models due to subjective feelings or improper judgments.
- 6) Parsimony: Mental models aim to minimize unnecessary and redundant actions.

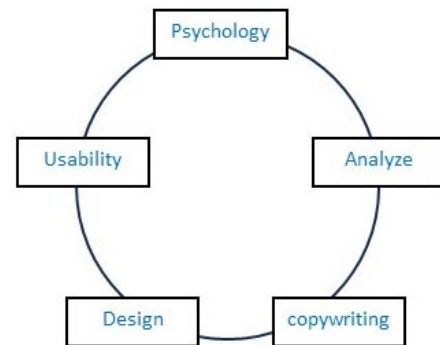


Fig. 1. Joel Marsh study.

#### E. User Interface

User Interface (UI), also known as user interface engineering or human-computer interface, primarily facilitates communication and interaction among people, devices, and systems. The "people" are the operators or users; the "devices" encompass hardware equipment or devices for application interfaces; and the "systems" refer to the information architecture of web pages or application devices. When users first encounter a system, their initial interaction is with the interface, rather than the system's functionalities and capabilities. Depending on the requirements and design of different projects, the presentation and design of the user interface will inevitably vary.

Preece defines user interface as the medium through which users communicate with devices. A well-designed user interface is one where users can easily comprehend all the subtasks within the system and interact effectively with the functional system [20, 21]. The user interface encompasses software elements (such as control procedures and visual displays) and hardware aspects (such as screen size, execution efficiency, and product appearance). It also encompasses engagement of the five human senses (such as visual, auditory, tactile, olfactory, and gustatory) [21], please see the Fig. 2.

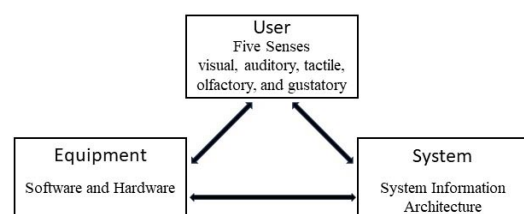


Fig. 2. Collection of data for this study.

Norman asserts that interactions with products or interfaces should be intuitive for consumers, and information design should align with consumers' logic. Regardless of whether users make errors due to misunderstandings, designers must acknowledge that everyone makes mistakes, and these errors shouldn't be blamed on the users themselves. In his book "The Design of Everyday Things" published in 2014, Norman outlined six principles for user interaction with UI points: [19–21]

- 1) Visibility: Elements and functions should be clearly visible to users.
- 2) Feedback: Users should receive feedback about their actions to understand the system's response.
- 3) Constraints: Design should incorporate constraints that guide users toward correct interactions and discourage errors.
- 4) Mapping: The relationship between controls and their effects should be intuitive and consistent.
- 5) Consistency: Design elements and behaviors should be uniform throughout the system.
- 6) Affordance: Users should be able to anticipate an element's function based on its appearance.

### III. RESEARCH METHODS

In the context of sustainable innovation in cultural and creative market interface design, integrating service design with environmental sustainability requires a precise breakdown and definition of each stage using the right tools, as employing appropriate tools can enhance the accuracy of devising strategies for specific or repetitive service design processes [20, 21]. Luo and Zhu scholars also highlight that service design tools may vary based on content, objectives, and practical circumstances, thus categorizing them into two main types:

- 1) Qualitative Research Methods: Including observational methods, user interviews, storyboards, and personas.
- 2) Quantitative Research Methods: Encompassing questionnaire surveys, market demand analysis, and customer value analysis.

For the sustainable innovation concept in cultural and creative market interface design, the main research process is outlined, please see the Fig. 3.

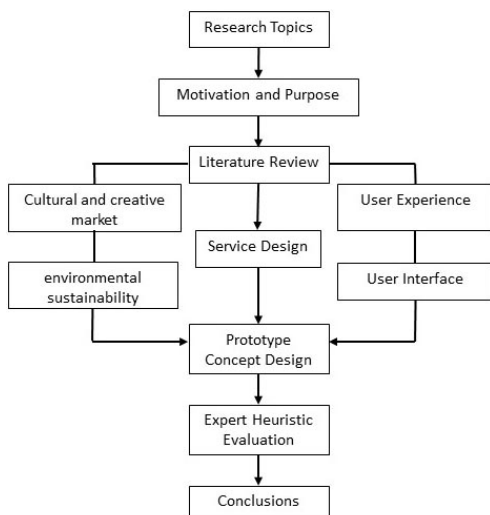


Fig. 3. Research process for this study.

#### A. Discovering Problems

First, conduct on-site visits to two major cultural and creative markets in Taichung, namely the "Small Snail Creative Market" and the "Jiu Jiu Creative Market." During these visits, observe and record the experiences of participants, including "consumers" and "market vendors," throughout their engagement in the cultural and creative market activities.

The "Small Snail Creative Market" is currently one of the most representative cultural and creative markets in the Taichung area. It was established in 2013 at the Taichung City Audit Village and later, most of its operations were situated at the "Da He Six Arts Cultural Hall - Taichung Prison Martial Arts Field," located at No. 33, Linsen Road, West District, Taichung City. The venue is divided into six main areas, with the market offering a variety of products, including locally grown produce, graphic and literary creations, handmade goods, and snacks and beverages.

The "Jiu Jiu Creative Market" joined the Taichung Cultural and Creative Industries Park located at No. 362, Section 3, Fuxing Road, South District, Taichung City, starting from 2016. The government transformed the former winery into the "1916 Creative Workshops," extending the event area from the Art Avenue to the R12 Lifestyle Design Hall. The market offers a diverse range of products, including illustration design brands, traditional crafts, inspirational literature, delicious foods, local stories of Taichung, and various lifestyle goods, please see the Table 1.

Table 1. Participatory observation of cultural and creative market

Market	Little Snail Cultural and Creative Market
Observation	
Market	1916 Cultural and Creative Market
Observation	
Market	Jiu Jiu Cultural and Creative Market
Observation	

This study also engaged in semi-structured interviews with 12 willing consumers and 10 market vendors. The interview process was transcribed verbatim and summarized into abstracts. Subsequently, participant customer journey maps were created for both consumer participants and market vendors, please see the Fig. 4. The objective of this process was to comprehensively analyze the pre-purchase,



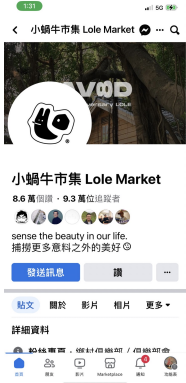

during-purchase, and post-purchase phases of consumer participants and market vendors during their involvement in the cultural and creative market. The aim was to gain insights into the challenges and perspectives of participants from different roles within the cultural and creative market.

Stage	During the Stay at the Cultural and Creative Market		
Primary Actions	Arrival at the Market	Motivation to Make Purchases	Interaction with Vendors
	<ul style="list-style-type: none"> <li>Exploring all stalls/sections</li> <li>Focusing on Favorite Brands</li> <li>Watching Performances</li> </ul>	<ul style="list-style-type: none"> <li>Observing Stall Advertisements</li> <li>Viewing the products showcased at the stalls</li> <li>Appreciating Fellow Stallholders' Creations</li> <li>Checking Product Price</li> </ul>	<ul style="list-style-type: none"> <li>Collecting Brand Business Cards</li> <li>Using Cash and Coins</li> <li>Mobile Payment</li> </ul>
Touchpoints	Market Venue	Market Vendors	Branded Merchandise
	Market Organizers	Consumers	Cash and Coins
	Market Vendors	Branded Products	Mobile Payment
	Performers	Branded Promotional Items	
	Official Website		
	Social Media Platforms		
Pain point	Limited mobility	Insufficient advertising information	Promotional items missing
	lack of booth signage	Inadequate product information	Insufficient change
	booths too close to each other	Low on-site product inventory	Lack of mobile payment options
	poor layout planning	Indifferent booth vendors	
	difficulty finding booths	lack of price labeling	
	absence of designated viewing areas for performances		
	unfamiliarity with performers		
	no marketplace map available at the venue		

Fig. 4. Participant customer journey map for this study.

## B. Discovering Digital Service

Table 2. Cultural and creative market user interface comparison

Market Logo	Small Snail Creative Market	Jiu Jiu Creative Market
		
Market Name	Small Snail Creative Market	Jiu Jiu Creative Market
Digital Platform	Official website Facebook	No Facebook
UI Service		


For the existing cultural and creative market user interface assessment, this study conducted a comparison and analysis focusing on the websites and fan pages of the “Small Snail Creative Market” the “Jiu Jiu Creative Market.”, please see the Table 2.

This study primarily focused on the mobile web interfaces of the “Small Snail Creative Market” and the mobile fan page interface of the “Jiu Jiu Creative Market.” A total of 12 consumers and 10 market vendors were invited to participate. Participants were tasked with four different missions. The researchers recorded participants’ operational processes and task completion times, which will assist in organizing time-related data from the tests and identifying interface-related issues.

## C. Cultural and Creative Market Interface Design

In this phase of the study, expert heuristic research was employed. Three experts with relevant interface design experience were invited to participate in this expert heuristic research. The selected experts encompassed individuals with expertise in backend planning, interface design, and extensive research experience in interfaces. Building upon the findings from the previous phase that investigated participants’ situations and identified interface issues within cultural and creative markets, this study developed two new prototype interface designs for the markets, labeled as Versions A and B. In consideration of the potential impact of color on the evaluation results during interface design, both versions were presented in grayscale with medium fidelity prototypes, please see the Table 3. Both versions were developed using a medium fidelity prototype design approach. The primary methodology for this phase was expert heuristic research.

Table 3. Comparison of version A and version B in the cultural and creative market interface

Market Name	Cultural and Creative Bazaar Mobile Device Version A
UI Style	
UI description	<ol style="list-style-type: none"> <li>The event dates are presented in a menu format, requiring careful reading of the subtitles to fully comprehend.</li> <li>Familiar interface operations seen in the current market will lead to a prominent logo upon clicking, followed by a set of sorting function buttons.</li> <li>The function buttons are purely text-based, which might appear less clear, potentially due to the nature of it being a prototype design.</li> </ol>

Market Name	Cultural and Creative Bazaar Mobile Device Version B
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UI Style



UI description

1. The primary information structure and nomenclature possess a guiding effect.
2. The registration form and brand display might cause confusion regarding which to click on; there is a need for greater clarity to ensure users are aware of clickable icons!
3. Placing the registration form in the upper right corner is a more accustomed practice and clearer. For categorizing brands and marketplace performance events, the use of icons for assistance would enhance clarity in my opinion.

In the final testing phase, experts and scholars will be invited to provide feedback on the user experience and usability of the two interface operation tasks, please see the Table 4. Based on their input, one of the prototype designs will be selected as the more suitable option for further planning and development.

Table 4. Background of Experts and Scholars

Serial number	Occupation/Background Brief	Years of experience
1	University Professor / Research Interface and Development	13 years
2	APP operation and maintenance engineer	7 years
3	Website and APP designer/video learning production, web APP visual design, layout cutting	3 years

#### IV. RESEARCH RESULTS AND ANALYSIS

##### A. The Actual Measurement and Analysis Results of the Problem-Seeking Interface Task

This study conducted empirical testing on participants of cultural and creative markets, specifically on the interface tasks of “Little Snail Creative Market” and “Juju Creative Market” in Taichung. The collected data from questionnaire surveys were analyzed and discussed as follows:

- 1) Table 5 presents an analysis of participant backgrounds and variables related to market participation. Frequency distribution tables and percentages are used as the primary descriptive content.

For this research, 12 consumers who have participated in

and set up stalls at cultural and creative markets, along with 10 market stallholders, were invited to participate in the interface testing for “Little Snail Creative Market” and “Juju Creative Market” in Taichung. After organizing the collected samples, the basic information of the research subjects, including gender, age, and place of residence, for both “consumers” and “market stallholders,” is provided. The analysis results are as follows:

Table 5. Consumer background questionnaire

Background question	Category	Times Allocation Table	Percentage
Gender	Male	4	33.3%
	Female	8	66.6%
Years old	16-25 years old	11	91.6%
	26-35 years old	1	8.3%
Place of residence	North	2	16.6%
	Middle part	9	75%
	South	1	8.3%
	East	0	0%

Based on the survey questionnaire and the results of data analysis, the explanations and interpretations are as follows:

- 1) Gender: In the gender statistical analysis results, it is evident that the proportion of “male” participants is 33.3%, totaling 4 individuals, while the proportion of “female” participants is 66.6%, totaling 8 individuals. This indicates that a majority of female participants visit the cultural and creative markets.
- 2) Age: From the statistical analysis results, it is observed that the proportion of participants aged “16-25” is 91.6%, totaling 11 individuals, and the proportion of participants aged “26-35” is 8.3%, totaling 1 individual. This suggests that the age group between 16 and 25 is dominant due to the prevalence of creative small items aligning with the preferences of young individuals. Following that, the age group between 25 and 35 is the next prominent segment.

##### B. Task time performance analysis

Four interface tasks were performed based on the specified criteria. Consumer task performance was analyzed for the following tasks:

- 1) Searching for Market Stall Information: Searching for the operating location and time of the market on April 2nd.
- 2) Searching for Market Vendor List: Searching for brands that had stalls on April 3rd and providing an example.
- 3) Searching for Market Vendor Location: Viewing precise vendor locations through descriptions or images.
- 4) Searching for Vendor’s Products: Identifying the products being sold by brands at the stalls on April 2nd.

Consumer task performance analysis was conducted using descriptive statistics and independent sample t-tests, as shown in Table 6. The results indicated significant differences for all tasks ( $P = 0.000 < 0.05$ ).

Task 1, “Searching for Market Stall Information,” revealed a significant difference with  $t(22) = 2.443$ ,  $p = 0.025$ . The time performance on the Little Snail Creative Market interface ( $M = 193.67$ ,  $SD = 123.0$ ) was higher than that on

the Juju Creative Market interface ( $M = 90.92$ ,  $SD = 78.05$ ). Observational analysis found that on the Little Snail Creative Market mobile interface, when searching for market stall information, consumers tended to look for the stall location (“Prison”) within the “Event Date” section. However, the indication of the market location (“Prison”) was too simplistic and unclear, which led to consumers not intuitively recognizing the venue. Additionally, the mobile interface did not display the operating hours on the same page; users had to click on the separate “Prison” section to access this information. However, in the “Prison” section, past stall dates were shown, which could mislead consumers when checking the timing, as it wasn’t clear if the market’s operating hours were the same for all dates at the “Prison” venue. The excessive hierarchical structure resulted in a less smooth user experience.

Table 6. Consumer task performance analysis

Task	Little Snail Cultural and Creative Market	Yaya Cultural and Creative Market	df	T-vaalue
Task 1	193.67(123.0)	90.92(78.05)	22	2.443
Task 2	17.92(10.958)	189.33(121.17)	22	-4.881
Task 3	106.33(120.172)	300.00(0.000)	22	-5.883
Task 4	79.08(104.981)	170.08(101.023)	22	-2.164

On the other hand, Juju Market displayed market information within photos posted as posts. This allowed users to easily find operating hours and location within the posts, although the small font size or low image resolution in the text within the image could lead to oversight. Overall, consumers had a clearer understanding of stall information on the Juju Creative Market compared to the Little Snail Creative Market.

Task 2, “Searching for Market Vendor List,” yielded a significant difference with  $t(22) = -4.881$ ,  $p = 0.000$ . The time performance on the Little Snail Creative Market interface ( $M = 17.92$ ,  $SD = 10.958$ ) was shorter than that on the Juju Creative Market interface ( $M = 189.33$ ,  $SD = 121.17$ ). Observation revealed that for consumers using the Little Snail Creative Market interface, finding the vendor list under the “Event Date” section was somewhat difficult. The unclear expression of the functionality’s intent led to misunderstandings, and many consumers inadvertently pressed this function button only to discover the current month’s market vendor list.

On the other hand, for Juju Creative Market, the list of selected vendors was announced on their Facebook fan page a week in advance. For consumers, searching for the vendor list involved checking posts on the page. However, special attention was needed to discern the content of the post or click on “Read more” to find the market vendor list. Overall, the information provided by the Little Snail Creative Market was well-organized and comprehensively presented, allowing for a quicker and more direct execution of the task.

## V. PROTOTYPE DESIGN INTERFACE OF CULTURAL AND CREATIVE MARKET

Based on the experimental testing tasks involving consumers and market vendors’ bosses related to versions A and B of the cultural and creative market interface designs,

data has been collated along with user interview suggestions. Therefore, within the context of the research topic, a sustainable innovation study is planned for the interface of cultural and creative markets. The ultimate validation involves the fidelity prototype design within the cultural and creative market. Seven participants are selected from the “consumers” and “market vendor friends” who were part of the problem exploration phase to perform prototype interface task tests. This is aimed at assisting in the collection of operational data and identifying issues in the prototype design. It serves as a reference for subsequent research related to cultural and creative markets or for the development of an online app. The information architecture of the cultural and creative market prototype design, as outlined in the research plan, is depicted in the diagram, please see the Fig. 5.

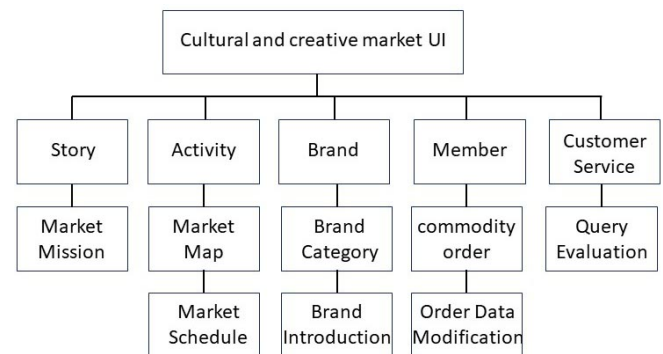


Fig. 5. Information architecture diagram.

Table 7. Visual framework pattern

Page Name	Welcome Page	Home Page
UI Framework		
Page Name	Member Centre Page	Brand Mall Page
UI Framework		

After conducting consumer testing and experimental tasks involving market vendors’ bosses for the relevant A and B versions of the cultural and creative market interface design,

data has been synthesized along with user interview recommendations. The main focus of this research topic is the sustainable innovation in interface design for cultural and creative markets. Within the visual framework pattern of interface design, the emphasis is placed on the overall user experience, visual recognition of functional symbols, and a significant emphasis on operational performance in terms of human factors engineering, please see the Table 7.

During the expert heuristic evaluation, for the final prototype design versions of the cultural and creative market interface, 20 key interface elements from both A and B prototype designs were evaluated by 3 expert scholars. They conducted relevant experimental task tests and provided descriptive statistics, rating each element on a scale of 1 to 7. After completing the tasks, the overall evaluation results for the A and B interfaces are presented.

Upon analyzing the average values, the fidelity prototype design in Version A ( $M = 3.66$ ,  $SD = 0.568$ ) scored lower than the fidelity prototype design in Version B ( $M = 4.03$ ,  $SD = 0.843$ ). The 3 expert scholars favored the prototype design in Version B, as indicated by their final evaluation, please see the Table 8. The experts and scholars provided the following recommendations:

- 1) The main information architecture and names should be guiding.
- 2) The homepage should include a location preview so that users can ascertain the exact location without needing to click further.
- 3) Visual symbols are clear and easily recognizable, both in the member center information page and throughout the interface.
- 4) For the brand list, using images makes it quicker to comprehend; try to include all necessary information.
- 5) When ordering products, the visual images of the ordered items should be clear. This aligns with users' visual reading behavior, guiding the visual flow from the top left to the bottom right, in accordance with the human visual scanning pattern.

Table 8. Expert heuristic descriptive statistics

Heuristic Questionnaire	Minimum value	Maximum value	mean (SD)
A Prototype Design (N=20)	2.7	4.7	3.66(0.568)
B Prototype Design (N=20)	2.7	5.7	4.03(0.843)

## VI. CONCLUSION

The concept of the global trend towards advocating for a net-zero carbon emission wave is becoming increasingly important. This trend spans various industries, academia, the service sector, and the food and beverage industry, all of which need to adopt "Net Zero" mechanisms. Simultaneously, there is growing global attention on the cultural and creative industries. Around the world, there are diverse cultural and creative market events, such as Christmas creative markets, Valentine's Day creative markets, and special themed creative market activities. These market events are closely intertwined with people, localities, environments, architectural spaces, and historical landmarks, among other factors.

Consequently, various subtle factors arising from market activities, such as the high-temperature steam generated from cooking, the substantial amount of beef-related foods and ingredients, discarded paper, plastic waste, and transaction receipts, contribute to greenhouse gas emissions and global warming effects. Cultural and creative markets have already become integral to people's daily lives. Therefore, these activities also need to align with the concepts of the "Net Zero Carbon Emission Wave" and the "Carbon Border Adjustment Mechanism" in Europe and the United States. By initiating net-zero carbon emission activities within small groups of cultural and creative markets, it is possible to achieve both environmentally sustainable practices and sustainable business models for these markets.

Furthermore, by scaling up these net-zero carbon efforts from small cultural and creative market communities to large corporate organizations, it becomes feasible to attain environmental sustainability and net-zero carbon emissions on a broader scale.

This study primarily focuses on the "Little Snail Creative Market" and "Jiu Jiu Creative Market" in Taichung. Adopting a service design perspective, the study explores the usability and interactivity of interfaces within creative markets. The objective is to uncover issues within the interface design of creative markets and the customer journey maps of market participants. Additionally, the study aims to assess whether the improvements made through this research result in a better user experience for both the creative market interfaces and the customer journey maps.

In this study, during the problem exploration phase, tasks involving creative interface testing were performed by consumers. Interviews were conducted to understand the purposes of consumers participating in the creative market, covering the pre, during, and post processes. Subsequently, a customer journey map was constructed, organizing and uncovering issues faced by consumers participating in the creative market. Following this, the prototype design of the creative market interface was redesigned, and a new customer journey map was formulated.

In the customer journey map, the red boxes represent the aspects of increased online usability and interactivity in the creative market interface prototype design developed as part of this research.

During the process of participating in the creative market event: Consumers can utilize the booth activity map within the creative market interface to learn about the brands participating on that day. If they have pre-purchased items, they can quickly locate the booth for picking up their orders, avoiding getting lost or having difficulty finding the right booth.

In the member center's order history, after consumers have completed picking up their pre-purchased items, they can provide brand reviews, allowing market vendors to understand how consumers evaluate their brand. This interaction fosters greater engagement between consumers and market vendors.

Comprehensive discourse on creative market interface prototype design points:

- 1) Overall Response: The usability of the interface for both creative markets is better than that of the pretest versions.

Having all the information available in a single app is excellent. The interactivity is quick and convenient, allowing users to easily find what they need. Most importantly, the time required for navigation is within a minute.

- 2) Visual Presentation: The prototype design is clearly marked and straightforward. It exudes vibrancy and the color scheme is lively and cute. However, the placement of the customer service center icon seems somewhat peripheral, and its expression is not entirely clear. It would be clearer with a small textual explanation. For the section regarding market vendor registration, it should be explicitly mentioned that registration needs to occur two months in advance.
- 3) Information Display: The flow of information is smooth, and various functions and messages are presented more clearly compared to the problem exploration stage. The majority of the icon symbols also have a cohesive connection. In terms of product sales, the information and messages are presented explicitly, making it easy to find the desired information.
- 4) Learning Presentation: Having a dedicated interface makes it clearer for users to navigate. This prototype design allows users to quickly search from the homepage if they can't find information, enhancing efficiency. When searching for information and tasks, the interface ensures high efficiency. The explanatory text beneath the functional buttons aids memory and learning for both first-time users and those who have been using the app for an extended period.

Cultural and creative market activities take place in physical spaces. By integrating digital technology services into these physical spaces, it becomes possible to enhance the overall user experience and achieve an environmentally sustainable business model.

The physical nature of cultural and creative market event venues often leads to a demand for physical paper materials. However, by reducing the use of paper and offering digital alternatives, such as utilizing mobile digital services or app interfaces, a novel and sustainable business model for cultural and creative markets can be established. This approach aligns with the current trends of minimizing environmental impact and embracing technology to create innovative solutions for the sustainable operation of cultural and creative markets.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### AUTHOR CONTRIBUTIONS

Yi-Chun Kuo1: Responsible for project thesis data collection and research, thesis writing project. Chung-Shun Feng2: Responsible for project paper editing and revision, visual interface design planning and user experience optimization design process. Chia-Wen Tsai 3: Responsible for project paper editing and revision, visual interface design

planning. All authors had approved the final version.

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