

Construction and Implementation of Agricultural Product Packaging Design Cloud Platform Based on 'Internet +'

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Abstract

In the "Internet+" era, the booming sales model of agricultural products has put forward higher requirements for packaging design that is conducive to increase the added value of agricultural products. The mobile agricultural product packaging design cloud platform with agricultural product information library, packaging product library, box shape library, and graphics library will be built in order to meet the needs of agricultural product operators for low-budget, efficient, and high-quality packaging design. The platform can quickly realize more intuitive and realistic agricultural packaging design through online selection and real-time preview of product box shape, color, pattern and material. Taking the waxberry packaging as an example, the platform tests different types of users and the system functions are performed normally. The test results show that this platform can effectively provide comprehensive services such as packaging optimization and packaging customization for various agricultural producers, wholesalers and sellers.

Keywords

Agricultural Product Packaging, Customization, Cloud Platform.

1. Introduction

In the context of "Internet+", various agricultural products have been successfully sold online. The data shows that the online sales of agricultural products in China amounted to 300 billion yuan in 2018. Online sales have become a new trend to solve the difficulty of selling agricultural products. At the same time, Internet sales require higher brand competitiveness for agricultural products and put forward higher requirements for packaging that affects brand communication and consumer purchase intentions. However, there is an embarrassing situation that now agricultural products on the market are "famous but unbranded", and the product packaging contradiction between supply and demand is becoming increasingly obvious.

With the integration of agriculture and digital technology, intelligent technology is widely used in various fields related to agriculture [1]. J.E.Relf-Eckstein introduced an example of a smart agricultural innovation case [2]; E.U. Chowdhury proposed smart packaging for the poultry industry [3]. More and more brands are handing over control of the design process to consumers [4]. Shuang Shan proposed an interactive system that users can flexibly manipulate the 3D carton from the 2D layout [5]. Dimitris Mourtzis put forward an AR-based framework research for implementing collaborative product design [6]. Zhinan Zhang proposed an architecture for intelligent manufacturing of customized products based on cloud systems [7]. This paper combines the existing research foundation of intelligent agriculture, intelligent packaging and custom platform to design a design cloud platform for agricultural product packaging. This platform can quickly implement the agricultural product packaging design required by users through online selection and real-time preview of product packaging box shape, color, pattern and material. It effectively provides comprehensive services such as

packaging optimization and packaging customization for various agricultural producers, wholesalers and sellers.

2. The Real Needs of Agricultural Product Packaging Cloud Platform under the New Trend of “Internet +”Sales

2.1. Weak Branding Power for Agricultural Products

A new wave of agricultural product brand design emerges from the new trend of agricultural product internet marketing. Consumer demand for agricultural products has increased from satisfying basic needs to the pursuit of refinement, specialization, quality and branding. Agricultural products that would be sold after sorting and packaging have been favored by consumers. At present, the strength of agricultural products branding is weak, and the “three products and one standard” (non-pollution products, green food, organic agricultural products and geographical indications of agricultural products) of major e-commerce and livestream platforms could be found everywhere. For example, the well-known “Yunnan Puer Tea” and “West Lake Longjing Tea” imperceptibly form an embarrassing situation of “famous but unbranded”.

2.2. The Cospicuous Contradiction between Supply and Demand of Agricultural Product Packaging Design

The effective expression of agricultural product brand requires excellent product packaging [8]. Packaging design plays a vital role in enhancing the added value of agricultural products, improving the shopping experience of consumers and promoting the brand development of agricultural products [9]. However, most farmers and operators of agricultural products lack the necessary background knowledge of packaging design. If they design their own product packaging, they will have no way of doing it; If they hire a design agency or individual to design product packaging, the design costs are generally higher than acceptable. However, online shops need to update their products continuously. The demand for agricultural product packaging optimization and iteration is frequent, and the contradiction between the supply and demand of agricultural product packaging has become more apparent.

2.3. Application Limitations of Existing Packaging Design Cloud Platform

Packaging design cloud platform is an online platform based on the Internet. It can simulate and predict the product packaging effect through the online selection of product packaging box shape, color, pattern, material, process, size modification and real-time preview of the three-dimensional effect of the box shape. There are three typical packaging design websites including Yundayang(China), Packly, Cloudlab, etc. We can find that their target consumer users are all designers with background knowledge of packaging design through the packaging design experience research of these three representative websites. The website provides various functions such as packaging design materials, pictures, expansion plans, tutorials, box structure selection and design for professionals. However, for non-professionals, the website has many discomforts: However, for non-professionals, the website has many discomforts: the box type is not classified according to the products used; the name of the box type is unfamiliar and difficult to choose; the 3D effect of real-time preview of the box type cannot display the material and the mapping, the final effect of the product is not intuitive; the customization mode is single, it starts from the box type selection optimization and lack of packaging finished model that can be directly applied.

It can be seen that if there is a cloud platform on the market specifically for agricultural product packaging design, the majority of farmers will complete their own ideal packaging design through simple operation. Farmers do not need to have superior design skills themselves or

hire designers to design. It will effectively solve the real dilemma of difficult, costly and cumbersome communication of agricultural products.

3. User Demand Analysis of Agricultural Product Packaging Design Cloud Platform

3.1. Pain Points and Demands for Users of Agricultural Product Packaging Cloud Platform

Based on the current situation and demand analysis of the relevant market participation roles, the platform targeted agricultural farmers and operators as typical consumers. Using field interviews to find out consumers' attitudes towards packaging design and discover real needs. A questionnaire (Survey on Consumer Demand and Experience of the Agricultural Packaging Design Cloud Platform) would be set up in response to the interviews and a quantitative study of consumers would be conducted. To combine qualitative and quantitative research on typical users and summarize the two major pain point needs of target users.

To combine qualitative and quantitative research on typical users and summarize the two major pain point needs of target users. The first kind of demand is the fine-tuning of packaging. It does not require innovative design of agricultural products, and makes minor changes on the basis of existing brand packaging or referring to the market general packaging style. For example, the product packaging iteration can be quickly realized by using the existing packaging box shape through changing the logo name, changing the package description text, replacing the visual graphics, etc. The packaging of this kind of agricultural products requires more speed and convenience, without excessive design creativity and quality. It is the rapid realization of new products at a lower cost. The second kind of demand is the packaging customization. Such demand for design aesthetic and brand requirements is higher, and it needs to be differentiated from the existing packaging of similar products on the market. It needs to reflect the strong brand characteristic and the core concept from the brand logo, packaging box shape, visual graphics to the material technology of the packaging box. It also needs to dock professional designers to make new agricultural packaging. This kind of demand is no longer just looking for speed, but requires a better sense of branding of agricultural products within reasonable cost, with the help of packaging to reflect the unique cultural IP, thus further realize the successful example of seizing the first opportunity in the Internet market.

3.2. User Experience Map of Agricultural Product Packaging Cloud Platform

Combining the above questionnaire results and the target customers' feedback on their use of the existing packaging platform, the customer journey map is drawn based on the main line of consumer role customization behavior as the picture 1 shows. It visually demonstrates the consumer group's behaviors and needs on the platform. To address pain points, propose opportunities and solve difficult problems, so as to clarify the positioning of the packaging design cloud platform and achieve a system functional architecture that meets user expectations.

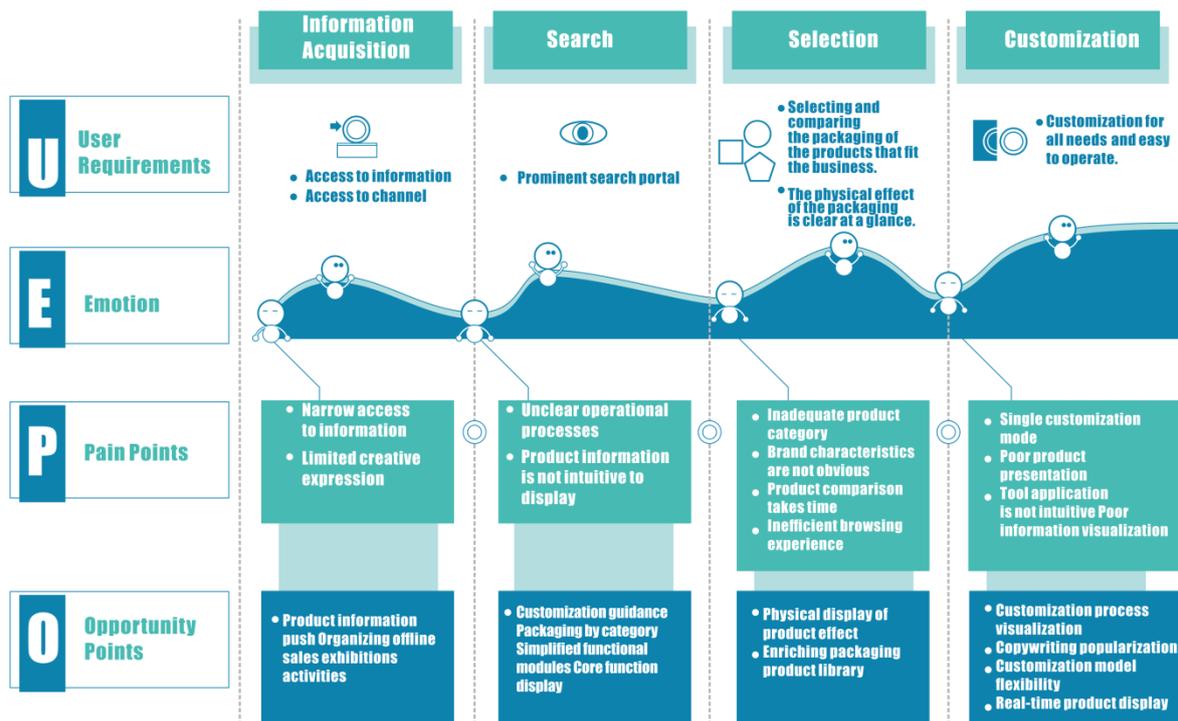


Figure 1. Customer journey mapping with a focus on customized consumer behavior

3.3. Functions of Agricultural Product Packaging Cloud Platform

According to the online agricultural packaging characteristics research and analysis of farmers' packaging requirements, it locks the user's two core needs of packaging optimization and packaging customization, and positions the main functions of the agricultural packaging cloud platform: packaging optimization and packaging customization. Other functions that assist these two core parts are: box shape selection, size adjustment, pattern selection, text addition, packaging 3D effect preview and modification, packaging expansion chart preview and modification, packaging custom design, packaging demand exchange and packaging knife mold order production.

4. Model Building and Design of Agricultural Product Packaging Design Cloud Platform

4.1. Cloud Platform Positioning

Agricultural product packaging design cloud platform is based on the design service concept and the Internet, and dedicated to the integration of all kinds of agricultural packaging design resources. It provides packaging optimization, packaging design and packaging production services for producers, wholesalers and sellers of various agricultural products. The user can implement the box design, material selection and pattern addition through selecting and previewing online on the platform, and obtain low-cost, efficient and precisely positioned agricultural products packaging to meet the user's individual needs, innovative needs and interactive needs. In addition, the packaging designers included in the platform can use order demands and production resources provided by the platform to broaden the agricultural packaging design cooperation channels, thus further promoting the sound functioning of this platform.

4.2. Cloud Platform Service System Architecture

The system uses a hierarchical architecture to provide system services, which can reduce the coupling of various parts and make it well scalable and maintainable. The system software architecture mainly includes seven layers: storage layer, data access layer, business layer, data interface layer, web layer, cache layer and app layer. The business layer is the core service layer of the system, interfacing with the data access layer and operating database services and storage services; the business layer also provides data support for WEB services, caching services and JSON interface services. It contains the following 10 core modules: (1) account, role privilege, organization system; (2) agricultural product information database; (3) packaging products library; (4) classic case library; (5) box shape library; (6) material library; (7) graphics library; (8) micro-design; (9) independent design; (10) trading system.

4.3. Cloud Platform Core Module Functions And Interactive Design

In order to provide farmers and designers with agricultural packaging information easily, and groups that focus on specific content are formed. The platform further plans each part of the content in the architecture, and collate the visual hierarchy and information layout of each module. The product packaging library, classic case library and other information acquisition functions are arranged in the homepage interface; the box shape library, material library and mapping library are integrated into the self-service design interface. To draw high-fidelity prototypes with Axure software to demonstrate the interactive framework and interface functions.

The homepage interface is divided into five parts: packaging design process, packaging product library, self-service design, classic packaging appreciation and community. It divides the area of different functions and contents for users with different needs. Packaging design process: procedure instructions customized for the user display platform; Packaging product library: provide the user with modifiable and optimized mature packaging for multi-category agricultural products; Self-service design: users can select online and modify on the platform to achieve the packaging box shape design, material selection and pattern addition, and to obtain the required packaging three-dimensional effect and the packaging expansion diagram; Classical packaging appreciation: a collection of classic cases of global agricultural product packaging including THEDIELINE, Red Dot, BESTAWARDS and EDAWARDS; Community: to induce consumers' purchase and customization behaviors through the display of completed orders, while complementing the agricultural product packaging design function of the promotion platform.



Figure 2. Homepage Interface

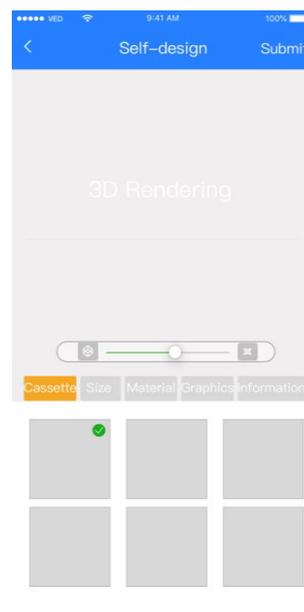


Figure3. Self-service Design Interface

Self-service design interface is divided into two modules, the upper side of the interface is the 3D real-time effect preview box for packaging products, and the lower side of the interface is the toolbox. If the customer selects a finished package for micro-adjustment, the toolbox contains menus for size, material library, sticker library, brand information, etc. Material library offers single copper paper, corrugated paper and other common packaging materials; Sticker library includes two types of diversified stickers, namely images of physical agricultural products and design graphics extracted from agricultural products. The user can adjust the size of the packaging box, the sticker or the material at any time, and the system would perform a series of calculations after receiving the product information. Then output the corresponding model and its expansion diagram. The top side preview box directly provides and generates the 3D effect picture so that the package pieces are presented in a more intuitive and simple way for the user. The user can place orders directly and proof the finished package to match the volume of the product. If the customer needs full self-service design, the toolbox will add the box shape library and the personalized custom message button. The box shape library includes common and special-shaped agricultural product packaging boxes such as swing cover type, window type, display type, portable type, closed type, drawer type and combined type. Consumers can independently choose the box shape and the basis of the sticker, and modify the length, width, height and other sizes. Or they can upload design images themselves and choose the corresponding materials for self-design. On this basis, further design requirements can also be inputted in the personalized custom message box to generate requirements postings to the community. Designers communicate online for specific needs and upload design models for users.

4.4. Cloud Platform Operation Service Process

Ordinary consumers enter the platform's interface, and firstly selects the type of corresponding agricultural products through the product packaging library, thereby entering the existing packaging product display library for such agricultural products. Then click on the expected box to enter the self-service design interface. The system displays the packaging box 3D model, the packaging box shape, size and other information in the self-service design interface. If the consumer is satisfied with the current packaging form, he or she can click the submit information button, enter the necessary information needs to be modified such as the brand name, text description, etc., and place a custom proofing order directly. If the consumer needs

to add their own design ideas on the basis of this kind of packaging, they can adjust the size, the sticker and other operations through the button. After finishing the independent design and then place an order for proofing.

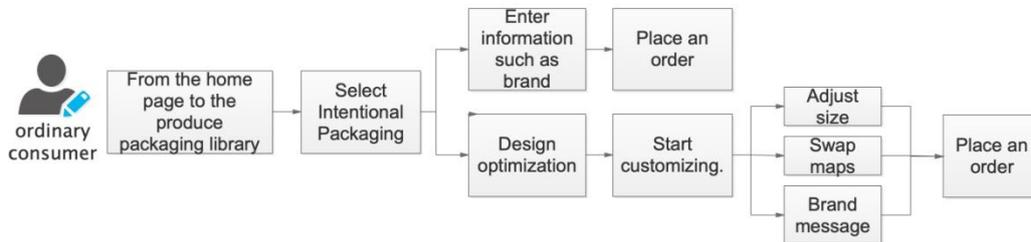


Figure 4. Ordinary Consumer Design Optimization Service Process.

Innovative consumers with unique needs can choose the packaging self-service design module when they enter the corresponding produce page. They can implement independent innovation design based on the box shape library, sticker library and material library provided by the platform. They can also post personalized needs posts, further communicate with the designers who are undertaking the task. The designer designs to meet user’s personalized needs before placing orders for production.

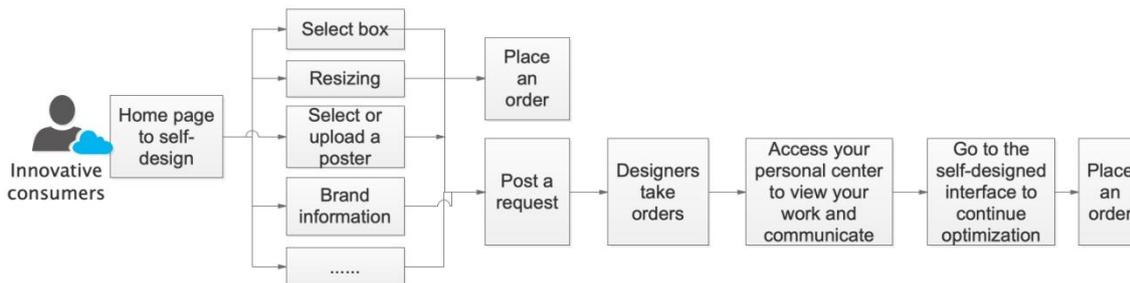


Figure 5. Innovative Consumer Custom Design Service Process.

5. Cloud Platform Design Practice - Chashan Waxberry Packaging Design

In order to test the usability of the target platform functions and modules, targeting the waxberry products and inviting two types of users with different needs, ordinary farmers and big growers respectively to test. The system functions operate normally.

5.1. Chashan Waxberry Packaging Requirements

The town of Chashan is located in Ouhai district, Wenzhou city, rich in agricultural products, with the most famous waxberry and Wenzhou orange. The cultivated area of Chashan waxberry is about 10,800 mu. It has won the title of National Geographical Indication Product, "Four Excellent Varieties of Waxberries in Zhejiang Province", Gold Medal of Zhejiang Province Agricultural Fair, etc. There are more than 6,000 waxberry operators in Dingao, Chashan. But in recent years it has encountered difficulties during the rapid development of the Internet economy era. Brands abound, but there is a lack of real brands with loud names; agricultural prod

There are three types of waxberry packaging: basket simple packaging, foam box hardcover and eggshell foam box hardcover. (1) Basket simple packaging: After picking waxberries,

regardless of the size and quality, put them directly into a small bamboo basket or plastic basket lined with waxberry leaves to complete the product packaging. (2) Foam box: After picking waxberries, select the great ones with small bamboo baskets plastic baskets, and put the bamboo baskets into the middle of the foam box with ice bags. Seal the foam box, then put the foam box into the carton and finish the product packaging. (3) Eggshell foam box: great waxberries would be individually packaged one by one. First put waxberries into the eggshell plastic box, then put the eggshell plastic box into the middle of the foam box with ice bags on both sides, and finally put the foam box into the outer carton to complete the product packaging. The latter two can basically keep waxberries fresh for about 3 days.

5.2. Waxberry Packaging Optimization Design Practice for Ordinary Consumers

Thang Jisong, a farmer in Chashan, has 20 acres of the waxberry plantation. The main sales channels are wholesalers’ door-to-door purchase, tourists’ retail and WeChat sales. In recent years, he mainly orders the product packaging directly from the packaging factory, and the factory will replace the text on the existing packaging on the market. Now it is hoped to strengthen the brand identity of the packaging at a low cost. It is hoped that there are a variety of different design and color of the outer packaging to provide options to make it different from Chashan waxberry packaging. It enables the customer to be impressed with his waxberries through the packaging.

After a brief registration, he selected the product packaging number sgy002 in the product packaging library. He was satisfied with the box shape and the overall color scheme of the package and decided to replace the existing package with this one. At this point, he entered the automatic design interface and carried out replacement operations such as material, sticker and brand information after learning about the selected box shape and size. Finally, the packaging optimization design was completed.

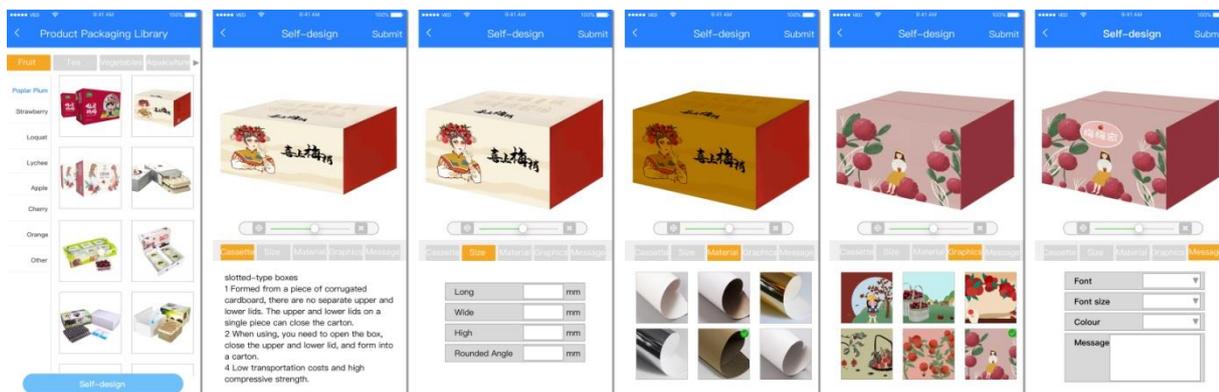


Figure 6. Various Operations from the Product Packaging Library to the Self-service Design.



Figure 7. Platform Packaging of the Consumer's Choice



Figure 8. Consumer-optimized Packaging Effects

5.3. Waxberry Packaging Customization Practices for Innovative Consumers

Dingao waxberry professional supply and marketing agency in Ou Hai District is a major operator in the waxberry planting base of Ou Hai District, which specializes in selling local waxberries. Xiao Xiuzhong, the operator of the agency, started to expand sales network in 2010. Now the market has been extended to all over the country, especially Zhejiang Province, Shanghai, Jiangsu Province, the Pearl River Delta and other areas. The daily sales of great waxberries in Taobao can reach 500 boxes in season. This supply and marketing agency hopes to design a great waxberry packaging of Chashan orchard sold in the local supermarket to attract consumers' attention through the clear brand image and fine product packaging. It is hope that the product packaging can show characteristics of nature, excellence and safety, create great Chashan waxberry online and gain more consumers' favor.

After a simple registration, he entered the self-design interface from the self-service design of homepage. With the guidance of customization, he inputted the clear information of the box shape and brand information and uploaded the waxberry information in the data-upload area. Then he inputted additional requirements in the message area: I hope the packaging can display some videos and photos to show farmers' pollution-free treatments in the process of growth and other key processes. The platform matches designers for this business and uses AR technology to present the huge amount of information requested by customers to consumers. After receiving notification that the designer has completed the first draft, consumers enter the platform's personal center to check the packaging and communicate further with the designer. Then click on the packaging link in the Personal Center to enter the Self-design interface again and make further adjustments and modifications based on the first draft provided by the designer.

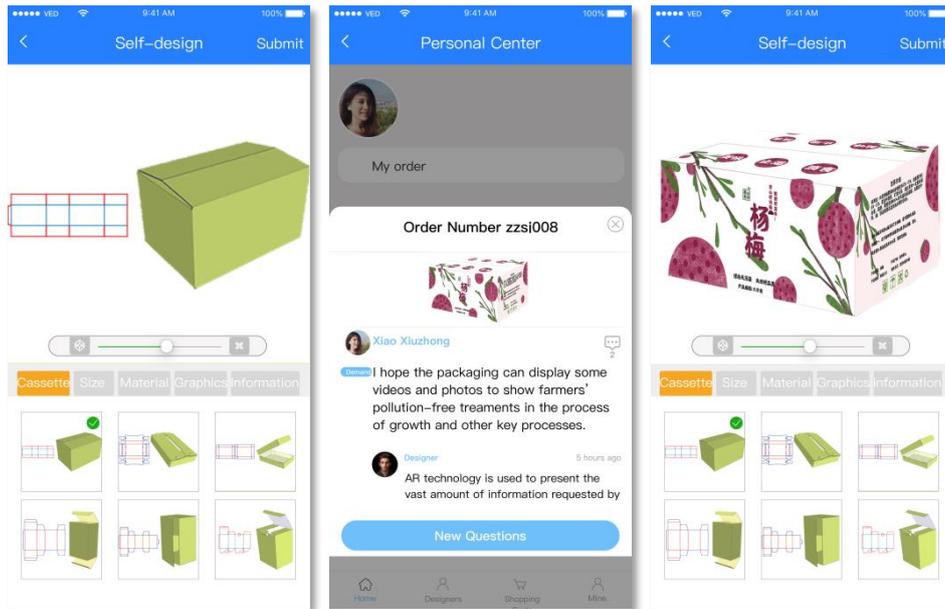


Figure 9. Platform Packaging of the Consumer's Choice



Figure 10. Custom Packaging Effects

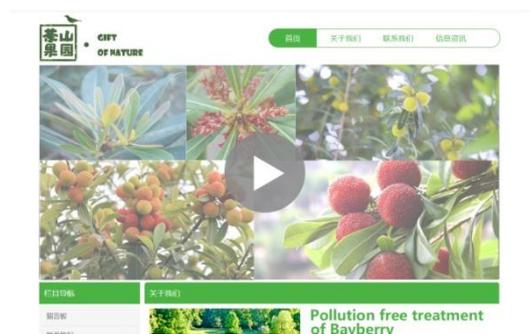


Figure 11. Information contained in the QR Code of the Package

6. Conclusions

This paper describes in detail the technical framework, functions and practical application effects of the cloud platform to meet the demands of agricultural products packaging and agricultural products operators packaging. To build a packaging design cloud platform through the integration of all kinds of agricultural product packaging design resources. The platform contains agricultural product packaging library, box shape library and sticker library, which can quickly realize packaging optimization, packaging design and packaging production

services. With the gradual application of the platform, it will effectively solve the demands of agricultural product packaging optimization and iteration in the context of online sales, and ease the contradiction between supply and demand of agricultural product packaging.

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