¹ Salvador V. Briones II*

² Shane C. Briones

Discursive Web-Based Schizophyllum commune (Kurakding) Knowledge Bank: A Repository of Regional Knowledge for Sustainable Use and Development

Abstract: - Kurakding (*Schizophyllum commune*) mushrooms are renowned for their health-promoting and medical benefits and is considered a high-value farm product. Its popularity in Bicol Region, Philippines, makes it in-demand, which therefore makes it an expensive commodity. Recognizing the significance of this commodity, the Kurakding Information System (KIS) was designed and developed to serve as a repository of regional knowledge for its sustainable use and development. Specifically focusing on functionalities that allow the users to create content, retrieve knowledge, and interact with other users using social network services. During the design and development, an innovative software development model, the KIS Software Development Paradigm (KISSDP) was used. This model is a systematic integration of methods and techniques on software development practices adopting concepts and standards from Agile software development methodologies which establishes an explicit compliance with the ISO/IEC 25010 standards. Following Jakob Nielsen's principles for interaction design, KIS was subjected to rigorous testing and evaluation measuring the system's user interface in conformance with UI design standards. Achieving high ratings in usability (95.90%), acceptability (94.67%) and reliability (93.33%). Given the limited study on the development and evaluation of information systems designed to support the marginalized sectors in the country, it is our hope that this research study provides significant insights into the software quality principles and competencies as universal standards for various software development projects that boost favorable customer satisfaction and optimum user experience.

Keywords: Kurakding, Schizophyllum commune, usability heuristics, information system.

I. INTRODUCTION

Partido Area, the 4ᵗʰ Congressional district in the province of Camarines Sur was blessed with rich flora and fauna and knowingly abundant in natural resources like land formation, bodies of water, plants, animals, protected areas, environmentally critical areas, and other endemic resources that supports the economic and livelihood activities of its residents.

Kurakding is a type of mushroom that is known for health-promoting and medical benefits and is considered a high-value farm product. Its popularity in Bicol, Philippines, specifically in Partido Area makes it in demand, which therefore makes it an expensive commodity. Kurakding as described by the locals is a light brown fungus that clings and multiplies on a moist of decaying tree branches, especially after the long rain. Kurakding has been cooked for their meals and its rarity is what makes it a sought-after commodity.

Recognizing the significance of Kurakding in health and the economic contribution it could bring to the inhabitants of the Partido Area, the authors found it necessary to design and develop a Kurakding Information System (KIS). The KIS will serve as a Kurakding repository of regional knowledge for its sustainable use and development. Specifically focusing on functionalities that will allow the user to create content, retrieve knowledge, and interact with other users using the social network services and other modules that will permit the user to view important KIS elements and knowledge.

Fig. 1 The Kurakding (*Schizophyllum commune*)

¹, ² College of Education, Partido State University, Goa, Camarines Sur, Philippines
* Corresponding Author Email: salvador.briones@parsu.edu.ph

The infusion of new and advanced technologies has allowed the certain industry to surge ahead and transform the way they cultivate, harvest, and distribute their commodities. The use of an information system has accelerated knowledge acquisition and sharing by adopting innovative ways to improve the existing information and communication process. Information systems provide users the ability to exchange information with other users and the application of ICT could enhance decision-making process [1]. This new revolution in information sharing helped address several challenges which resulted in increased productivity and income.

Schizophyllum commune or locally known as Kurakding is a widely distributed wood-decaying basidiomycete that has been reported for its health-promoting and medical benefits [2]. It has a fruiting body of 10-50 mm wide, is fan-shaped with wavy margins, and appears to be lobbed. The upper surface is hairy and grayish-white in color. The undersurface is composed of gill-like folds that are split down the middle, and also whitish to grayish. Kuo (2003) identified Kurakding by its tiny fruiting bodies which lack stems, and they attach themselves like tiny bracket fungi on the dead wood of deciduous trees. Unlike other bracket fungi, Kurakding has gills on its underside, rather than pores or a simple, flat surface. On close inspection, the "gills" turn out to be merely folded in the undersurface and they are very distinctively "split" or "doubled". The species is edible and widely consumed in Southeast Asia [4].

The creeping urbanization and increasing population put severe pressure on resources such as idle land where Kurakding grows, making it rare. It grows profusely after the rainy season where the right amount of humidity and heat provide the ideal condition for growth. Because of its 'rarity,' Kurakding now commands a premium in the market. Additionally, Kurakding has been reported for its health-promoting and medical benefits. It has recently attracted the medicinal industry for its immunomodulatory, antifungal, antineoplastic and antiviral activities that are higher than those of any other glucan complex carbohydrate [5].

Moreover, studies have shown that the application of information communication technology has been beneficial for agricultural development. According to Vidanapathirana (2019), ICT-based agriculture information support systems are vital for the dissemination of agricultural information and technical knowledge to farming communities. Demiryurek et Al., (2008) pointed out that the implementation of an Agricultural Information System can help inform decisions regarding land, labor, livestock, capital, and management to understand better their decisions in order to take advantage of market opportunities and manage continuous changes in their production systems. Information systems have also been applied in crops such as mushrooms. Bramantara et al. (2020) presented a study on mushroom cultivation that uses a smart farm system. This farm system has been used by mushroom farmers to easily monitor and maintain the conditions of temperature and humidity in mushroom cultivation through their website to produce superior mushrooms.

Owing to the beneficial properties of Kurakding and the application of ICT for agricultural development, the the comprehensive Kurakding Information System (KIS) was designed and developed which will serve as a repository of regional knowledge for every resource and information thus generating reports and other visual information that will be accessible in the public domain. Specifically, this study documented the comprehensive resources about Kurakding in the region ranging from its collecting sites, uses, benefits, application and products, designed and developed the KIS Front-end integrating functionalities such as a data entry page for content creation, knowledge retrieval features, social network services, and other viewable elements, and conducted a heuristic evaluation on the usability of the KIS.

II. METHODOLOGY

A. Research Design

This project utilizes the descriptive and developmental methods of research. It employs the descriptive method because it focuses on the compilation and documentation of the resources about Kurakding ranging from its biological characteristics, collecting sites, uses, benefits, application, and products. On the other hand, this project also employs a developmental method since its primary emphasis is on the development of the Kurakding Information System. Specifically following the phases in KIS Software Development Paradigm (KISS-DP) such as planning and analysis, collaboration, and deployment.

B. Data Gathering

Secondary data gathering was conducted to compile knowledge on Kurakding ranging from its collecting sites, uses, benefits, application, products, biological characteristics etc. Research data and outputs on Kurakding, as well as records was also considered. Interviews was also conducted to validate secondary data. Focused group discussion (FGD) was also considered in formulating the operational guidelines and procedures on the deployment and usage of KIS.

During the evaluation phase, a survey instrument was developed to evaluate the usability of the KIS using the parameters stipulated in ISO 20510:2011 software quality standards. For this stage, a simple descriptive treatment of data and qualitative approach was done.

C. Respondents

Key informants in this study were the Kurakding cultivators, processors and vendors, Kurakding researchers from Partido State University, mushroom researchers from other institutions, mushroom growers/farmers in the region and the concerned people from the Department of Agriculture.

III. RESULTS AND DISCUSSIONS

A. Kurakding Collecting Sites

Kurakding is a saprophytic fungus that can be found growing on dead or decaying wood of various trees and shrubs. It is a widely distributed mushroom and can be found in many different types of forests and wooded areas all around the world. In particular, Kurakding is commonly found growing on hardwoods as well as on coniferous trees. It typically grows on fallen logs or branches, but can also be found on standing dead trees, living trees or stumps, and on dead or dying shrubs.

Kurakding is a versatile fungus that can tolerate a range of environmental conditions, including temperate and tropical climates, and a variety of substrates, such as decaying wood, sawdust, and even on animal dung. This adaptability has made it a successful colonizer of many habitats and it is often one of the first fungi to appear on newly fallen logs.

To collect this kind of mushroom, it is important to look for distinctive fan-shaped fruiting bodies that have a split gill structure. These fruiting bodies can be small and may require a careful search to locate. As with any mushroom, it is important to be familiar with the identification characteristics and safety considerations before consuming them.

B. Kurakding Uses and Benefits

The Kurakding is a versatile mushroom that has numerous uses in different fields. These include culinary use, traditional medicine, bioremediation, industrial applications, scientific research, animal feed, biotechnology, cosmetics, antibacterial agent, mushroom cultivation, biodegradable materials, biocontrol agent, and many more.

This type of mushroom is well known to be edible and has been traditionally consumed in certain regions of Asia, such as China, Japan, India, Korea, and the Philippines. Kurakding can be used in a variety of dishes, including stir-fries, soups, stews, and salads. The mushroom has a firm texture and a slightly nutty flavor that can add depth and richness to a range of dishes.

In some cultures, Kurakding has been used for traditional medicinal purposes. It was believed that Kurakding has various health benefits, such as anticancer, antimicrobial activity, antiparasitic, and immunomodulatory function, and has been used also to treat a variety of common ailments including coughs, colds, digestive issues inflammation, and infection [9]. Recently Sun, T.K. et al. (2022), presented the findings of their study that Kurakding, alongside adenosine, exhibits potential for the repression of SARS-CoV-2 infection via the ACE2 and TMPRSS2 axis.

Kurakding also has the ability to break down pollutants and contaminants in the environment. As such, it has been studied as a potential tool for bioremediation, particularly in the cleanup of oil spills.

In addition to this, Kumar, et al. (2022) discussed the many functions and industrial application of Kurakding in the food industry, pharmacy, and oil recovery. It also produces a variety of enzymes and proteins that have potential applications in biotechnology. For example, the fungus produces laccase, an enzyme that can be used in the production of biofuels and in the treatment of wastewater. The bioactive compounds produce in Kurakding could lead to the development of new drugs, biodegrades certain types of plastic, enhances soil health, and has potential in bioprospecting.

Kurakding has been studied extensively by scientists due to its unique biology and genetics. It is often used as a model organism in genetic and molecular biology research, particularly in the study of cell differentiation and development. This valuable organism offers a range of applications and is still being explored by researchers.

C. Kurakding Products

The Kurakding species was regarded as nonpoisonous and edible by Wongaem, A. et al. (2021). It is widely consumed in certain regions of Asia, such as China, Japan, India, Korea, and the Philippines.

In Bicol, Philippines, Kurakding was considered a high-value farm product and one of the oldest favorite Bicolano delicacies. Similar to oyster mushroom, it is accepted as a vegetable usually cooked with coconut milk and chili. Some farmers dry this Kurakding and sell it in the market. In Northeast India, in the state Manipur, it is

known as *kanglayen* and one of the favorite ingredients for Manipuri-style pancakes called *paaknam*. In Mizoram, the local name is *pasi* (*pa* means *mushroom*, *si* means *tiny*) and it is one of the highest rated edible mushrooms among the Mizo community [12].

D. Design and Development of Kurakding Information System

This initiative, to design and develop the Kurakding Information System (KIS) was viewed as an indispensable gesture for the sustainable use and development of Kurakding, particularly in the Partido area where it was considered an in-demand commodity. The Kurakding Information System will serve as a repository of information on Kurakding regional knowledge. Moreover, since KIS is a knowledge bank, it could also help address the dearth of accessible knowledge on the Kurakding industry and could contribute to the development of the industry having been identified as one of the important commodities in the local community. The system was designed with flexibility in mind to interface and interconnect/link with other systems allowing for a dynamic web of knowledge.

During the design and development of KIS, the researchers developed an innovative software development paradigm, the KIS Software Development Paradigm (KISS-DP). Figure 2 presents the KISS-DP.
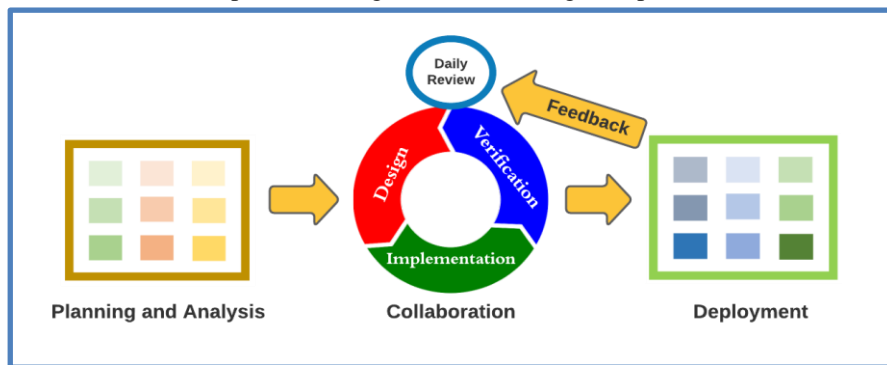

Fig. 2 KIS Software Development Paradigm (KISSDP)

The entire process of the development of the Kurakding Information System follows a strict adherence to the researcher's made software development procedures. This paradigm is actually a systematic integration of methods and techniques based from the researchers' software development practices and partially adopting concepts and standards from Agile software development methodologies. Specifically, these procedures establish explicit compliance with the ISO/IEC 25010 standards that ensures functional, efficient, compatible, maintainable, reliable, portable, secure, and usable software will be delivered to the target users in due time. During the verification process, the researchers employ an evaluation team that examines the interface and judge its compliance with the recognized software quality principles. Accordingly, this evaluation method helps to identify the usability issues and problems in the development processes and user design.

The project primarily started through a systematic planning and analysis phase which is essentially a high level feasibility discussion of the objectives, vision and resources for the project. The project's requirements were scrutinously defined and the ROI were properly justified. During this phase, the researchers also conducted the data gathering, structured interviews, recording, and identifying data and information the system should accommodate. These include categorizing information related to Kurakding and developing functionalities the system will provide.

The collaboration phase marks the start of the first iteration of the software project with the aim of delivering a working version in its due time. The Kurakding Information System was designed in this phase to be a framework for information sharing and management. The KIS will be provided with information from various sources.
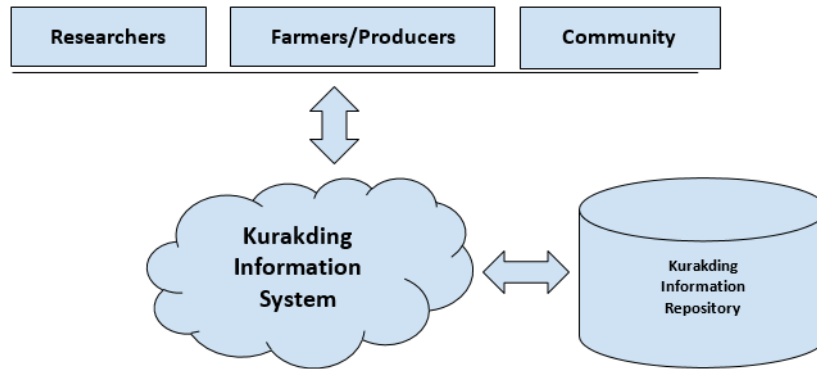
Fig 3 KIS Logical Framework

Identified requirements and functionalities in the requirements analysis phase will be converted into working modules for the information system. Different web frameworks and technologies were utilized to develop the KIS. Specifically, the proponent used PHP, JavaScript, and HTML for the frontend and MySQL for the backend. Daily reviews were also conducted to ensure the efficiency and effectiveness of the conducted activities and the productivity of the team. A verification process was also employed to examine the interface and judge its compliance with the recognized software quality principles. Accordingly, this evaluation method helps to identify the usability issues and problems in the user interface design and in the overall performance of the system.

The main functions of KIS were classified into three categories (Fig. 4). These are content creation, content retrieval, and social network services. Content creation has an additional three sub functionalities such as posting of Kurakding information, uploading of Kurakding research, and posting of comments/suggestions. Similarly, the content retrieval also had two sub-functionalities which are the viewing of Kurakding knowledge and uploading of Kurakding research. And finally, social network services have one sub functionality which is the online forum. These functionalities were designed to ensure that the functional requirements of the Kurakding researchers, farmers, consumers, etc. were properly met.
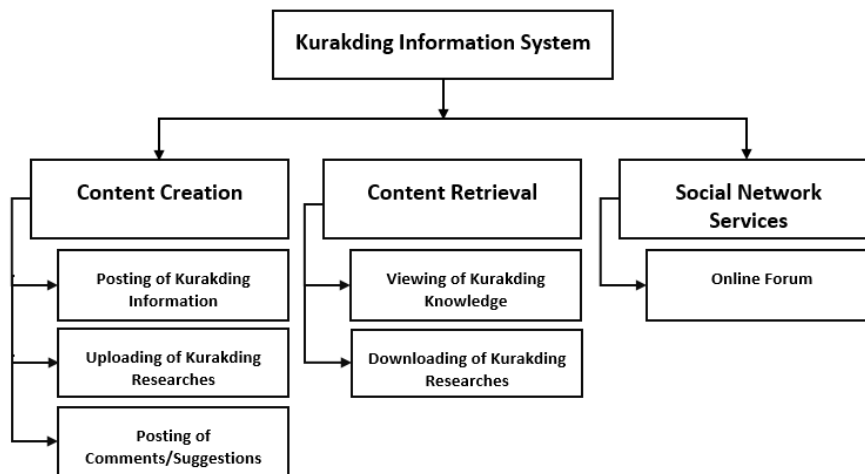

Fig. 4 KIS Functional Diagram

To further demonstrate the role of every actor in the KIS, Use Case Model was also presented (Fig. 5). These model provided a high level view of the system's functionality and the different ways in which the user can interact with the system.
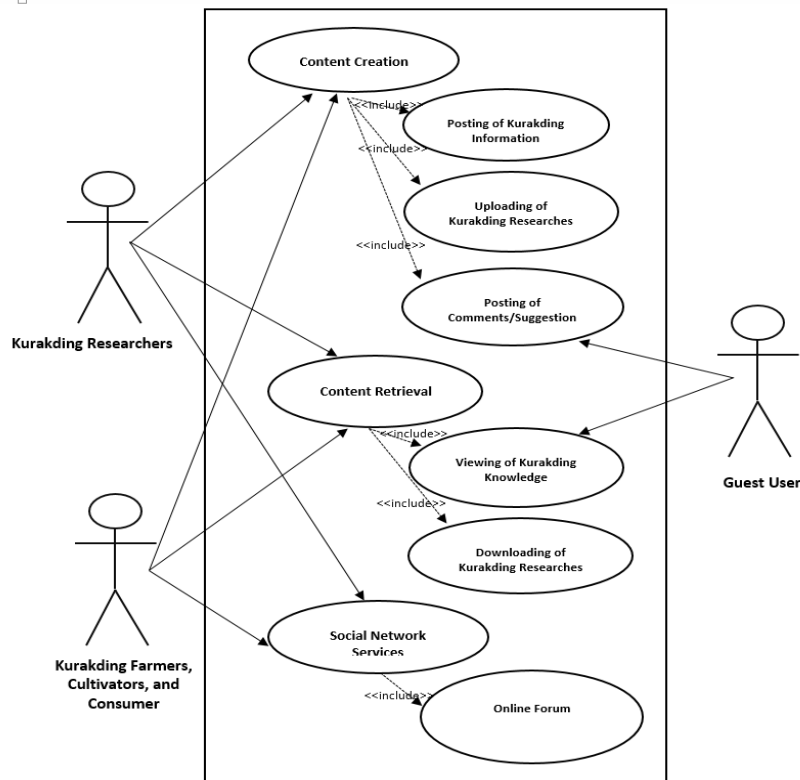
Figure 5. KIS Use Case Model

As presented in the figure, KIS has three main actors which are the Kurakding researchers, Kurakding farmers, cultivators and consumers and guest users. Kurakding researchers, Kurakding farmers, cultivators and consumers were given the privilege to create and retrieve contents as well as to use the social network services function. Ordinary user can only view contents and post comments and suggestions.

In the same way, the KIS User interface provided a way for the KIS users to interact with the system. The KIS interface includes links for the about, identification/gallery, FAQ, recommendations, forums, and publications

The final process in the paradigm was the deployment of the system. The system was closely monitored for bugs and some defects that may have been missed during the verification phase. During this stage, relevant training with the stakeholders was conducted to ensure a highly usable, highly reliable, and highly acceptable software product will be handover to them.

Various user types were also implemented in this phase to manage the integrity of the information provided by the system. System administrators, content creators, farmers, and researchers will be the entities that will contribute to the repository of data. Regular users will be limited to viewing and accessing the information on Kurakding.

This phase was also designed to conduct tests from the potential users of the system where feedback and inputs will be collected to further improve the KIS.

E. System Evaluation

Following Jakob Nielsen's principles for interaction design, the developed Kurakding Information System was subjected to rigorous testing and evaluation by a diverse group of stakeholders, who focused on measuring the system's user interface in conformance with UI design standards. Table 1 displays the usability percentage of the Kurakding Information System, which was deemed to be "highly usable" with an average grade of 95.90%.

Table 1. Usability Percentage of Kurakding Information System

No.	Usability Heuristics Indicators	Summary of Results (%)
1	Visibility of System Status	96.70
2	Match Between System and the Real World	95.80
3	User Control and Freedom Support undo and redo.	97.61
4	Consistency and Standards	95.80
5	Error Prevention	93.85
6	Recognition Rather than Recall	95.49

No.	Usability Heuristics Indicators	Summary of Results (%)
7	Flexibility and Efficiency of Use	96.10
8	Aesthetic and Minimalist Design	96.10
9	Help Users Recognize, Diagnose, and Recover from Errors	96.10
10	Help and Documentation	95.49
	TOTAL	**95.90**

Note: 90-100, Highly Usable; 70-89, Usable; 50-69, Fairly Usable; 30-49, Less Usable; 29-0, Unusable

The stakeholders gave the Kurakding Information System average ratings of 94.67% "highly acceptable" and 93.33%, "highly reliable" for the acceptability and reliability of the KIS. This high rating was attributed to the high quality of the system because of stringent compliance with the well-known and widely acknowledged software quality standards and resolutely adhering to the KIS Software Development Paradigm. Both Table 2 and Table 3 give a summary of ratings about the acceptability and reliability of the KIS.

Table 2. Acceptability Percentage of Kurakding Information System

No.	Acceptability Indicators	Summary of Results (%)
1	The objectives of the KIS were clearly defined.	95.19
2	The KIS is useful at my present work.	95.5
3	The use of KIS facilitates my tasks.	97.01
4	The information provided in KIS are helpful.	94.59
5	The contents are well organized and consistent with the objectives of the KIS.	93.68
6	Participation and interaction of users were encouraged.	95.5
7	Instructions were clear and understandable.	95.19
8	KIS provided opportunities to practice and reinforce previous knowledge.	93.98
9	Users are able to contribute contents into the information repository through their accounts.	92.47
10	I will use the KIS to assist my operation.	93.55
	TOTAL	**94.67**

Note: 90-100, Highly Acceptable; 70-89, Acceptable; 50-69, Fairly Acceptable e; 30-49, Less Acceptable; 29-0, Unacceptable

Table 3. Reliability Percentage of Kurakding Information System

No.	Reliability Indicators	Summary of Results (%)
1	The information presented in the system is accurate, complete, and current.	94.95
2	Content and context are consistent with the objectives of the KIS.	95.25
3	All information relates to the stated purpose and project goals.	96.47
4	Multimedia appears to be directly related to the stated purpose and project goals.	94.95
5	The layout is clear and intuitive, users can always find what they need.	91.62
6	The pages work in most common browsers like Mozilla, Google Chrome, Internet Explorer, etc.	95.56
7	Paragraphs and sections have clear and accurate informative headings.	91.92
8	Clear and complete directions are available for access.	91.92
9	Help users recognize, diagnose, and recover from errors.	88.28
10	Can bring a failed system to full operation.	92.4
	TOTAL	**93.33**

Note: 90-100, Highly Reliable; 70-89, Reliable; 50-69, Fairly Reliable; 30-49, Less Reliable; 29-0, Unreliable

IV. CONCLUSION AND RECOMMENDATION

In any software development project, the intricateness and dynamism of the software are viewed as the prevailing attributes that affect the outcome of the project. However, with the explicit utilization of the recognized software development practices and the acknowledged paradigms along with the clear vision and right attitude towards the development of the project, there is likely a high possibility of achieving greater success for the project. Presented in this paper are the results of the efforts in the design and development of the Kurakding Information System, the user experiences (UX), and the stakeholder's response to the usability and UI design of the system.

The system's major functionalities include content creation, content retrieval, and social network services which were designed to ensure that the functional requirements of the Kurakding researchers, farmers, consumers, etc. were properly met.

By firmly complying with the known and highly recognized software quality standards and firmly adhering to the researchers' KIS Software Development Paradigm, the stakeholders mark the Kurakding Information System as "highly usable", "highly acceptable" and "highly reliable".

Given the limited study on the development and evaluation of information systems designed to support the marginalized sectors in the country, it is our hope that this research study provides significant insights into the software quality principles and competencies as universal standards for various software development projects that boost favorable customer satisfaction and optimum user experience.

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