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An Effect of Information System Quality of BRIS on Perceived Usefulness and User's Continuous Use Intention

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Abstract

BRIS has been established by the Ministry of Agriculture, Food and Rural Affairs since 2011 under Article 21 of the Act on the Preservation, Management and Utilization of Agricultural Life Resources. It is an information service that provides information related to agricultural life resources in connection with the Rural Development Administration, the Forest Service, and Korea Seed & Variety Service, Agricultural Resources and Agricultural and Livestock Quarantine Headquarters.

The purpose of this study is to evaluate how the users assess the information system quality (information quality, system quality) for the current Bio Resource Information Service (BRIS). Ultimately, the structural equation modeling analyzes the causal relationship between each variable and how it responds to the user's continuous use intention.

As a result, information quality among information system quality and information quality among system quality used as the main variables for the evaluation of BRIS were statistically positively influenced by users' perceived usefulness, while system quality It has been analyzed to have a positive effect on the sustained use intention. The user's continuous use intention is positively influenced by the information system quality and perceived usefulness at a statistically significant level. Especially, the perceived usefulness plays a role in mediating the user's continuous use intention.

Keywords

Bio Resource Information Service, BRIS, Information Quality, System Quality, Perceived Usefulness, User's Intention to Use continuously

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1. Introduction

As with the 4th Industrial Revolution, 'bio-economy' has emerged as a paradigm that pursues sustainable growth as a new important national economic growth engine based on 'bio-technology'.

According to the OECD 'The Bioeconomy to 2030 - designing a policy agenda' in 2006, 'bio-economy' is defined as a concept 'encompassing a variety of economic activities that bring benefits to humankind through the distribution of new products and service improvement through the development of life sciences.' Industries that are closely related to biotechnology are agriculture, bioprocessing, health care, bioelectronics, the environment and bioenergy, etc. These industries are expected to become important economic growth engines driving future economic growth.

An important factor that supports this bio economy is life resources. Life resources include living things (animals, plants, microorganisms, human cells, etc.) and their components (DNA, genomes, etc.) and their information. In particular, agriculture-related biotechnology technologies identify materials that create high added value in agricultural biomass, being used as functional foods or new drug materials and thus increasing industrial value. In addition, in accordance with the actual effectiveness of the Nagoya Protocol[1)] in August 2018,

1) Nagoya protocol is an international norm adopted by the 10th Congress of Biodiversity Conventions held in Nagoya, Japan in 2010, with the purpose of achieving fair and equitable profit sharing (ABS : Access to genetic resources and Benefits-Sharing) of the benefits arising from access and use of genetic resources. Prior Informed Content (PIC) is required from the donor country when accessing a BGT. When a foreigner approaches a domestic genetic resource for use, he or she must report it to the national institution responsible for it. Overseas genetic resources users should report to the inspector to comply with the procedures of the provider country and to verify compliance with the procedures. The inspection body may recommend conducting and complying with the investigation as necessary (Ministry of Environment "Nagoya Protocol Guidebook" 2011).

it officially faced the age of 'life resource sovereignty,' and in order to support continuous securement, management and utilization of useful agricultural life resources[2], the Ministry of Agriculture, Food and Rural Affairs, based on Article 21 (Information and Human Resource Development, etc.) of the Act on the Preservation, Management and Utilization of Agricultural Life Resources, the Rural Development Administration, the Forest Service, Korea Seed & Variety Service and Agricultural and Livestock Quarantine Headquarters connected together since 2011, and by linking and integrating information on agricultural life resources, built an information system called 'BRIS'.

Although Bio Resource Information Service (BRIS) is currently providing information services for the general public and professionals, since it does not go through the user registration process (log in), it actually only provides one-way information provision to unspecified users. Ever since the information service began, a survey on user satisfaction with the information service is conducted every year when the information service is updated as its assessment. Nonetheless, the evaluation on the information system has not been analyzed empirically.

Accordingly, this study will provide how users evaluate the information system quality (information quality, system quality) concerning BRIS, what are the influences the perceived usefulness of the user's level of acceptance of the information system based on the results, and by applying the causal relationship between each variable to the structural equation modeling analysis, find the responses to the users' continuous use intention, to ultimately propose a direction for improving the bio resource information service (BRIS).

2) Nagoya protocol is an international norm adopted by the 10th Congress of Biodiversity Conventions held in Nagoya, Japan in 2010, with the purpose of achieving fair and equitable profit sharing (ABS : Access to genetic resources and Benefits-Sharing) of the benefits arising from access and use of genetic resources. Prior Informed Content (PIC) is required from the donor country when accessing a BGT. When a foreigner approaches a domestic genetic resource for use, he or she must report it to the national institution responsible for it. Overseas genetic resources users should report to the inspector to comply with the procedures of the provider country and to verify compliance with the procedures. The inspection body may recommend conducting and complying with the investigation as necessary (Ministry of Environment "Nagoya Protocol Guidebook" 2011).

2. Theoretical Background and Precedent Studies Review

2.1 Information System Quality

Pitt et al.(1995) generally divided the information system quality into information quality, service quality and system quality. By measuring these factors, the information system performance can be analyzed.

According to Bailey & Pearson (1983) and Byeong-won Lee, information quality refers to the content of information output from the information system and the value of the content or what is related to the characteristics. The measured variables are mainly the up-to-date quality, accuracy, and the quality of information content. Since most information system users evaluate subjectively, it is included as part of user satisfaction.

System quality is the system's own ability to process information within an information system and indicates the operational efficiency of information system functions. This is mainly related to whether the system has an error. Most studies measuring the system quality of an information system measure the availability, responsiveness, and reliability of the system. The main measurement factors are the ease of access to information system, system response / reply reaction time, and system suitability, which considered as factors of evaluation.

Service quality mainly refers to the quality of information system services and is mainly about the overall management of the information system department. The primary evaluation factors used include what quality of service is provided for education, training, counseling, etc.

2.2 Perceived Usefulness

The level of accommodation of an information system can be divided into perceived usefulness and user satisfaction. In particular, Davis's TAM (Technology Acceptance Model) of 1989, which is widely used to explain and predict information system users' acceptance of information technology based on the rational behavior theory of social psychology, used perceived usefulness and perceived ease of use as factors influencing the attitudes and intentions of users.

According to DeLoan & McLean (1992), the successful information system model for measuring information system performance used six variables such as system quality, information quality, user satisfaction, personal effects, and organizational effects. Here, the system quality and information quality affect system usage and user satisfaction, while system use and user satisfaction affect individual performance, thus influencing the

organization itself. Concerning this model, Seddon (1997) analyzed the relationship between perceived usefulness and user satisfaction using perceived usefulness instead of system usage.

Hee-seok Park (2005) stated that 'perceived usability' is 'the degree to which one can perceive that using information systems can provide efficient and effective help'. In other words, it gives considerable influence on the user satisfaction to the extent that the users believe that the use of information systems will help them perform their jobs and have a positive impact on improving their work performance.

Likewise, with Onnara system that is being used by the central administration in Korea as a target based on proven concepts such as Seddon, So-young Yoo and Hong-jae Lee (2011) used the complemented and improved DeLoan & McLean (2003)'s information system success model as theoretical foundation and analyzed that out of the quality of information system, system quality and information quality had a positive effect on the users' perceived usefulness and user satisfaction.

Ki-hoon Han and Jin-soo Kim (2013) based the 'mobile electronic government service characteristics' on DeLoan & McLean's (2003) information system success model and analyzed the effects of information system quality (information quality, system quality, service quality) on user acceptance level, ease of use and usefulness, and the effect factors of user acceptance level on the mobile electronic government service users' intention to use continually

2.3 User's intention to use continually

Oliver (1980) explained the ECT (Expectation-Confirmation Theory) model as the relationship between consumer satisfaction and repurchase behavior. According to ECT, consumers form initial expectations before purchase and build awareness of the performance of the product or service used after a period of consumption. In this state, subjective satisfaction is determined by checking the expectation compared to the initial expectation. When the satisfaction is high, a repurchase intention is formed. The ECT model is used to explain the intention of users to use information systems continuously in the field of information systems. A primary example is Bhattacherjee's (2001) study. Based on Davis's TAM model, Bhattacherjee (2001) proposed a 'post-acceptance model' of analysis that presents that the satisfaction with the initial use of information system users and perceived usefulness affect the intention to continue using the information system. In Davis (1989)'s TAM model, he proposed the analysis results that indicate that perceived usability, along with ease of use, directly affects the user's intention to use continually.

Young-joo Moon and Jong-ho Lee (2012) stated that the determining factor of the continuous use of the life resource information service is the satisfaction of the use of the information system. Furthermore, it was stated that variables affecting information system use satisfaction include information quality, self-efficacy, and user training.

3. Research model and hypothesis

3.1 Research model

The purpose of this study is to analyze what are the effects of the quality of the information system evaluated by the Bio Resource Information Service (BRIS) users on the perceived usefulness and the user's intention to use continually regarding the information system.

Among the information system qualities, information quality and system quality were defined as independent variables. Perceived usefulness and user's intention to continually use were set as dependent variables. The relationship between these variables is defined as the research model shown in <Figure 1>.

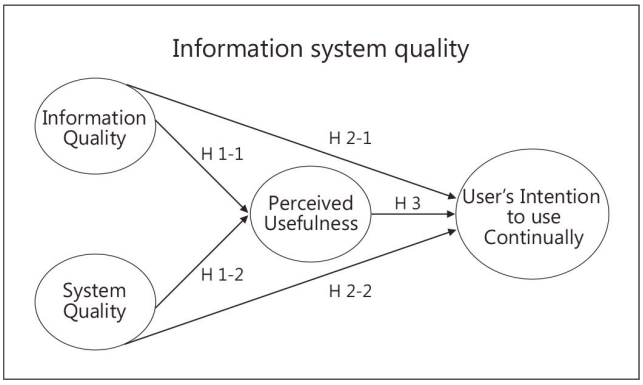

Figure 1. Research Model

3.2 Research Hypothesis

In order to conduct this study, a research model was established based on the theoretical background and previous studies discussed above. The following hypotheses were derived from the relationship between each variable.

3.2.1 Relationship between information system quality and perceived usefulness

In the information system success model of DeLoan & McLean (2003), the information system quality was

divided into information quality, system quality and service quality. Furthermore, these variables were used as highly critical variables in the success of information systems. In general, these variables were used as independent variables in information system evaluation. In addition, in the TAM model of Davis (1989), it was shown that these variables affect the perceived usefulness. The users' evaluation of the service quality of life resource information service (BRIS) are not included in this analysis because they are not statistically significant. A hypothesis was made concerning the relationship between information quality, system quality and perceived usefulness.

Hypothesis 1. The quality of the information system of Bio Resource Information Service (BRIS) will have a positive influence on the perceived usefulness.

1-1: The quality of the information of Bio Resource Information Service (BRIS) will have a positive influence on the perceived usefulness.

1-2: The quality of the system of Bio Resource Information Service (BRIS) will have a positive influence on the perceived usefulness.

3.2.2 Relationship between perceived usefulness and the user's intention to continually use

By basing the ECT model on Bhattacherjee's (2001) study, which suggested a 'late acceptance model' applied to information systems fields, we applied the information regarding that the perceived usefulness of the initial use of information system users is related to the intention of continuous use of information systems to the hypothesis of this research.

Hypothesis 2. The perceived usefulness of Bio Resource Information Service (BRIS) will have a positive impact on users' continued use intentions.

3.2.3 Relationship between information system quality and the users' intention to use continually

With research results showing that the information quality, system quality and service quality are the key independent variables of DeLoan & McLean's (2003) information system success model influence perceived usefulness and that perceived usefulness affects user satisfaction, as well as Ki-hoon Han and Jin-soo Kim's (2013) research results, we applied the hypothesis that the effects of information quality, system quality, and service quality on the user acceptance level, usability and usefulness and that user acceptance level factors affect the user's continuous use intention.

Hypothesis 3. The information system quality of Bio Resource Information Service (BRIS) will have a positive impact on users' continued use intentions.

3-1: Information quality of Bio Resource Information Service (BRIS) will have a positive effect on users' intention to use continuously.

3-2: The system quality of Bio Resource Information Service (BRIS) will have a positive effect on the users' intention to use continuously.

3.3 Definition and measurement of variables

In order to measure the variables in this research, a 7-point Likert scale (1 point = highly agree, 7 points = highly agree) was used. Table 1 below presents the operational definitions of the study variables and the survey items.

Table 1. Operational definitions and measurement items of research variables

Research variable	Operational definition and measurement item	Related studies
Information quality	User's perception level of the information provided by life resource information service (BRIS)	DeLoan & McLean(2003), Bailey & Pearson.(1983), Byeong-won Lee(2002)
	IQ1. Timeliness of BRIS information content	
	IQ2. Readability of BRIS information	
	IQ3. Accuracy and accountability of BRIS information	
	IQ4. Adequacy of BRIS information provision	
System quality	User's perception level of system performance of life resource information service (BRIS)	McLean(2003), Seddon and Kiew(1996), Park Hee-seok (2005)
	SY1. Satisfy load time for web page conversion using BRIS system	
	SY2. Provide reliable service without failure and failure of BRIS system	
	SY3. Ease of providing BRIS system	
Perceived usefulness	The extent to which using life resource information service (BRIS) helps with users' work performance	Davis(1989), Seddon(1997), Hee-seok Park(2005), So-young Yoo· Hong-jae Lee(2011)
	US1. BRIS information contents help with work performance	

Research variable	Operational definition and measurement item	Related studies
	US2. BRIS information contents help with work ability	
	US3. BRIS information contents increase work productivity	
User's intention to use continually	The extent to which one intends to use life resource information service (BRIS) continually	Bhattacherjee(2001), Ki-hoon Han, Jin-soo Kim(2013)
	WI1. Will use BRIS continually	
	WI2. Recommend BRIS system to someone else	

3.4 Sample and Data Collection

In this study, a survey was conducted and data concerning the target of analysis was collected to statistically verify the research hypothesis. The target of the survey was set as users of BRIS information system, the survey sample was set as respondents of this survey, and data were collected by non-probability bias extraction. The survey was conducted from July 10 to September 5, 2019 and a total of 36 questionnaires were collected. This was used as the final valid sample for analyzing the results. SPSS Win 21.0 and SmartPLS 3.0 statistical programs were used for analysis.

4. Empirical Analysis

4.1 General characteristics of sample

When considering the respondents' each occupational situation, researchers (research institutions / corporate research institutes) covered more than half (55.6%) of the total, followed by 'other' such as university professors or related organizations with 16.7%. Most of the respondents were in the plant field.

4.2 Verification of the adequacy and reliability of the measurement items

The uni-dimensionality of the research unit composed of several items was analyzed using factor analysis and reliability verification using SPSS 21.0. The factor analysis was set as main ingredient analysis, Verimax technique was used as KMO, commonality, factor loadings are each over .500, unique value was set as 1.000 or higher, and cumulative variance of 60.000 or more was set as the standard value. Reliability verification was based on the Cronbach Alpha coefficient of .700 or more. Since the AVE value of each variable item was small (36), the value was not calculated.

Firstly, when information quality and system quality as independent variables were analyzed, after removing the 3rd item of system quality, KMO=.771, unique value was 1.628 and cumulative variance was 82.000. Factor loadings and commonalities were all over .500. The confidence coefficient was information quality .857, and system quality was .807, securing adequacy and reliability.

After analyzing the perceived usefulness as a result variable and the user's intention to use continuously, there were no removed items and KMO=.865, unique value was 1.891 and cumulative variance was 87.577. Factor loadings and commonalities were all over .500. The confidence coefficient was information quality .938, and system quality was .804, securing adequacy and reliability.

Table 2. General characteristics of sample

Classification		Frequency(%)	Classification		Frequency(%)
Occupation	Public servant (Resource Conservation Agency)	2(5.6)	Interest resource field	Animal (Livestock)	2(5.6)
	Researcher (Government-funded research institutes, private research institutes, etc.)	20(55.6)		Plant	26(72.2)
	Office worker (Regular company)	4(11.1)		Insect	2(5.6)
	Worker in the life resource-related field (Bio-company)	4(11.1)		Dielectric	2(5.6)
	Other (University professor, related organization)	6(16.7)		Microorganism	2(5.6)
				Breed Application Information	2(5.6)

Table 3. Verification of the adequacy and reliability of the measurement items

Classification	Factor loading value	Commonality	Confidence coefficient	χ2 Statistics and degree of freedom
Information quality 2(IQ2)	.883	.847	.857	χ2=95.988, Degree of freedom=10
Information quality 1(IQ1)	.881	.826		
Information quality 3(IQ3)	.745	.674		
System quality 1(SY1)	.951	.945	.807	
System quality 2(SY2)	.699	.807		
Perceived usefulness 2(US2)	.894	.924	.938	χ2=139.168 Degree of freedom=10
Perceived usefulness 3(US3)	.857	.895		
Perceived usefulness 1(US1)	.805	.860		
User's intention to use continually 2(WI2)	.865	.873	.804	
User's intention to use continually 1(WI1)	.805	.828		

The average of the measurement items ranged from 5.19 (1.01) to 5.68 (.95). After analyzing Pearson's correlation for the correlation between variables, all were found to be r = .473 ~ r = .764 (p <.010). In particular, r = .653 (p <.010) was less than .700 in the presence of multicollinearity between independent variables, indicating that there is no multicollinearity of independent variable.

Table 4. Correlation analysis between measurement items

Classification	Information quality	System quality	Perceived usefulness	User's intention to use continually
Information quality	1			
System quality	.653*	1		
Perceived usefulness	.708*	.473*	1	
User's intention to use continually	.740*	.629*	.764*	1

* p<.1, ** p<.05, *** p<.001

4.3 Verification of Research Hypothesis

The structural relationship that analyzed the influence relationship between the independent variable and the resultant variable is shown in the following table. From hypothesis 1-1 of hypothesis 1, although the effect of information quality in perceived usefulness (β = .496 t = 2.438, p <.05) in the Bio Resource Information Service (BRIS) was analyzed as significant, the hypothesis on the effect of system quality on perceived usefulness in information systems was found to be statistically insignificant and was thus rejected.

Furthermore, the perceived usefulness of R^2 is 44.1%, which means that the information quality and system quality in Bio Resource Information Service (BRIS) have some explanatory power.

In addition, hypothesis 2, which is the effect of perceived usefulness on the user's continuous use intention (β = .459, t = 2.489, p <.05), was analyzed to be statistically significant. As such, the user's perceived usefulness regarding Bio Resource Information Service (BRIS) has a positive effect on the user's continuous use intention.

Hypothesis 3-1 of hypothesis 3, which is the hypothesis about the effect of the information quality in the information system on the user's continuous use intention, was statistically insignificant and thus rejected. Hypothesis 3-1, which is the effect of system quality in information system on user's intention to use continually (β=.510, t=2.511, p<.05), was analyzed to be statistically positive.

R^2 of user's intention to continually use turned out to be 77.4%. Accordingly, it can be said that the quality of information, quality of system, and perceived usefulness of users in Bio Resource Information Service (BRIS) fully explain the users' intention to use continuously.

Table 5. Structure model analysis results

Classification	Medium	Number of medium β)	t	p	f^2	Results
Hypothesis 1-1	Information quality → Perceived usefulness	.496	2.438	0.015**	0.254	support
Hypothesis 1-2	System quality → Perceived usefulness	.224	1.376	0.170	0.052	dismiss
Hypothesis 2	Perceived usefulness → User's intention to use continually	.459	2.489	0.013**	0.521	support

Classification	Medium	Number of medium β)	t	p	f^2	Results
Hypothesis 3-1	Information quality → User's intention to use continually	.037	0.179	0.858	0.003	dismiss
Hypothesis 3-2	System quality → User's intention to use continually	.510	2.511	0.012*	0.629	support

* p<.1, ** p<.05, *** p<.001

4.4 Effect size (f^2) analysis

According to Chin (1998) & Cohen (1988), effect size analysis accounts for the relative differences between independent variables for dependent variables. According to the calculated value of the independent variable, it is divided into three criteria: .02 (small), .15 (medium), and .35 (large).

As shown in <Table 5>, regarding the effect size of the information quality that is an independent variable and the system quality on perceived usefulness and users' intention to use continually, the effect size of system quality (0.629) on user's intention to use continually came out to be greater than the effect size of the perceived usefulness (0.521) on the user's intention to use continually and the effect size of the information quality (0.254) on perceived usefulness.

4.5 Medium effect analysis

The medium effect analysis using bootstrapping was performed as shown in <Table 6>. As a result, it was analyzed that mediating effect occurred in information quality → perceived usefulness → user's continuous intention to use in Bio Resource Information Service (BRIS).

Table 6. Medium-role analysis using bootstrapping

`Medium	Number of medium(β)	t	p
Information quality → Perceived usefulness → User's intention to use continually	0.028	1.731	0.084*

* p<.1, ** p<.05, *** p<.001

5. Conclusion

5.1 Summary of research results and implications

This study analyzed the correlative effect of information system quality (information quality, system quality) on users' perceived usefulness and the user's intention to use continually, with users of Bio Resource Information Service (BRIS) as the target. The results and implications are as follows.

Firstly, we used information quality and system quality among information system quality as main variables for BRIS evaluation. The direct effects of these variables were different. While information quality had a statistically positive effect on users' perceived usefulness, the system quality was analyzed to have a positive effect on the user's continuous use intention.

This disproves that users of Bio Resource Information Service (BRIS) who participated in the survey for this research receive positive impact from BRIS' information quality on their work performance, and that this information service contributes to increase work productivity of actual users. However, the analysis results which indicate that the effect of system quality of BRIS on perceived usefulness is not statistically significant show that the H / W sector or service support sector that supports information service is not sufficiently supported from the user's point of view.

However, in terms of the user's intention to continually use, it was found that system quality had a positive impact instead of information quality. This is because there is no alternative information service system in relation to agricultural bio-resources, and because some of the users who participated in the survey conduct work that actually provides content to Bio Resource Information Service (BRIS). However, these two variables (information quality, system quality) alone do not account for the perceived usefulness. Subsequent studies related to this study should continue to conduct research involving the discovery of new variables that affect the perceived usefulness of Bio Resource Information Service (BRIS).

Secondly, the users' intention to use continually received positive effect at a statistically significant level on information system quality and perceived usefulness. The explanatory power of these variables on the user's continuous use intention was high. In particular, the medium role of perceived usefulness regarding the user's continued intention to use should be noted. Although the direct impact on the user's intention to continually

use regarding information quality was dismissed because it was not statistically significant, to have positive effect through perceived usefulness indicates that it helps the user in the center of users to work, and that the contents of Bio Resource Information Service (BRIS) should be expanded to be beneficial.

As stated above, the current Bio Resource Information Service (BRIS) is categorized into regular user contents and professional user contents to provide unilateral information service. In the future, however, it is necessary to prepare a method for processing information content for each content that a user wants through practical classification (professional or bio company managers' work usage, education for the public, related organizations and life resource related work support, companies wishing to use agricultural life resources in Korea, etc.) of actual users through the user registration. The information update cycle should also be reorganized into a system that updates the information at any time when generating information managed by each information provider, rather than expanding the information once a year.

Furthermore, the physical infrastructure that currently provides Bio Resource Information Service (BRIS) was found to be not dramatically improved when the information service began in 2011. However, consideration should now be given to the expansion and reinforcement of major H / W and N / W, or to the improvement of information service system in the government's computer resource management by transferring the entire system to the government integrated computer center as public information (the top domain is used as .go).

5.2 Limitations of the research and future tasks

This research conducted a user evaluation regarding information system, user's perceived usefulness and intention to continually use regarding the information system of Bio Resource Information Service (BRIS) that supports conservation, management and use activation of agricultural life resources, which are the foundation of bio industry that is emerging as a new growth engine of Korea's economy, through a structural equation model analysis for the first time. However, this study has the following limitations.

Firstly, the number of users (survey samples) who participated in the Bio Resource Information Service (BRIS) assessment to conduct this research was too small. As a result, some verification items could not be calculated for the validity and reliability of the research items. Furthermore, because a sample with non-probability bias method was chosen, there were limitations on whether enough logical/substantial proof were proposed for the purpose of the research. Of course, it was necessary to conduct user evaluation on the unspecified number of subjects under the condition that they fully recognized the presence and use of Bio Resource Information Service (BRIS). Furthermore, although the questionnaire in this study was conducted for one month using this procedure, only 36 copies were completely recovered.

Secondly, although this research was approached as a complete information system evaluation, in the future, studies should be conducted on the main contents of Bio Resource Information Service (BRIS) regarding the factors influencing the user's use behavior and main behaviors regarding the use behavior.

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