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# TASTE VISUALIZATION TECHNIQUE FOR ONLINE FOOD SHOPPING MALLS: DEVELOPMENT AND APPLICATION

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## Abstract

The main goal of this study is to visualize tastes of foods and agro-products to reduce the uncertainty of purchasing of them in online shopping malls. To accomplish the goal, we select two Korean traditional foods; Kimchi and Gochujang, develop the criteria for visualization of their tastes, choose about ten products for each food that are on sale in the online shopping malls, make visualization tables and apply them to the real shopping mall. And then, we contrast the customer satisfaction, purchasing pattern, and sales of both before and after applying the taste visualization tables.

**Keywords:** Taste Visualization; agro-product; e-commerce

## Introduction

While the aggregate monetary amount of e-commerce transaction is continuously increasing, the proportion occupied by agro-product transaction is not very significant [1]. As the quality of agro-products may vary it is not easy for consumers to easily assess both the taste and the quality simply by looking at the agro-products in monitor display, which leads consumers to perceive high uncertainty.

While a plethora of research have investigated consumption pattern and purchase intention process associated with e-commerce environment [2], how the uncertainty associated with purchase of agro-products in e-commerce can be mitigated has received little attention. Also, no attempt approach has been made to analyze how the user's visiting pattern or purchasing pattern changes when website information successfully fulfills user's sense or curiosity that has not been fulfilled before.

To understand the changes, it is necessary to analyze changes in user behavior by performing click stream data analysis. As click stream analysis enables understanding of user migration path and stay length, it has been widely applied to help in understanding user decision making process or improving migration path within a website [3], [4], [5].

The purpose of this study is to conceive technique for visualization of taste and examine how the conceived technique mitigates uncertainty associated with online agro-product purchase.

Consequently, visualization models of Kimchi and Gochujang, two of the most frequently sold agro-products in Korean e-commerce environment, is developed and applied at actual e-commerce web pages to analyze how the application of visualization models affect consumer satisfaction and purchase intention.

Kimchi, one of the most popular Korean side dish, is a pickled dish made of vegetables (cabbage in most cases) with varied seasonings. Taste differs according to various factors such as vegetable and seasoning used, and period of fermentation. Gochujang is savory and pungent fermented Korean condiment made mainly of pepper. The word 'Gochu' means pepper and 'Jang' means condiment.

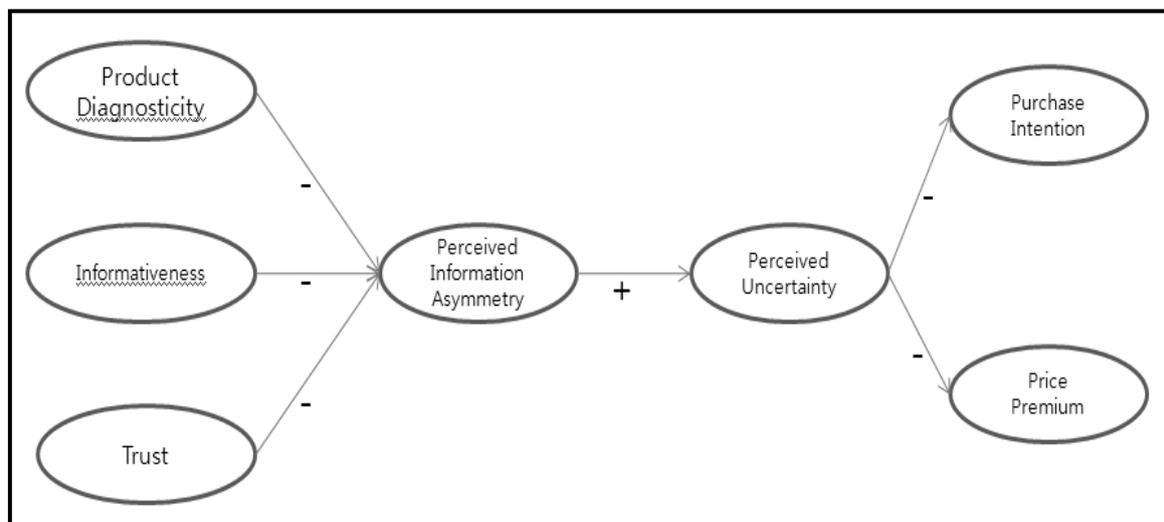
Based on the analysis, the study suggests strategies to apply visualization technique to increase the amount of e-commerce agro-product transaction and increase the overall size of domestic markets for agro-products and traditional food.

## Theoretical Background

### Uncertainty

Perceived uncertainty refers to "the degree to which the outcome of a transaction cannot be accurately predicted [6]". As uncertain factors can rise in all types of transactions to negatively affect the predicted outcome, buyers cannot predict whether a transaction will be successfully fulfilled or not [6]. Pavlo have developed a conceptual model, by integrating the principal-agent perspective with information systems, marketing, and sociological theories, to identify sources of perceived uncertainty and factors that mitigate the uncertainty sources in e-commerce environment. [7].

According to this model, 'perceived information asymmetry' and 'fears of seller opportunism' are the sources of perceived uncertainty. However, 'fears of seller opportunism' is not considered in our study as it is less relevant. If buyers are fully aware of a product quality before purchasing, there will be no information asymmetry [8]. However, as consumers in e-commerce environment cannot see or feel an actual product before a purchase is made and the product is delivered, information asymmetry arises and consumers perceive it.



<Figure 1. Uncertainty Mitigation Model

(Partially adapted from [7] and [16])>

‘Product diagnosticity’, ‘Informativeness’, and ‘trust’ are factors that mitigate perceived information asymmetry.

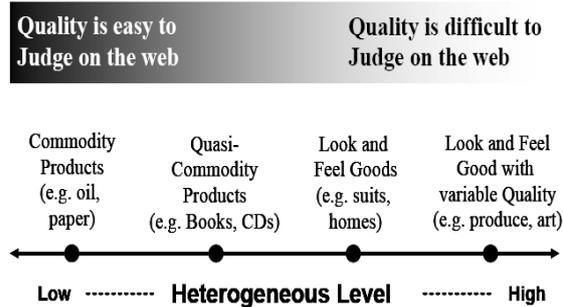
Product diagnosticity is defined as the extent to which a buyer believes that a particular shopping experience is helpful in terms of evaluating the quality of a product [9], [10]. Informativeness is defined as the extent to which information provided is resourceful and helpful to consumers [11]. Trust is defined as the intention of consumers to accept vulnerability of a transaction by believing that the seller will not act opportunistically [12].

When perceived uncertainty is decreased, purchase intention increased as a result. In the study of [16], Pavlou’s model was further developed and applied to analyze effectiveness of food traceability system. According to this study, decreased perceived uncertainty increases consumers’ willingness to pay price premium.

Relationships between variables are shown in <Figure 1>.

When e-commerce consumers purchase products, the quality of which can easily be judged on the web, they tend to select products with lower price regardless of information provided by sellers. De Figueiredo developed an e-commerce product continuum and examined four points on the continuum [13]. These products include oil, paper, clips, etc. However, when consumers intend to select products with variable quality, they want to “look and feel” the products. When e-commerce environment cannot satisfy consumers’ desire to look and feel, uncertainties tend to rise and consumers’ purchase intention changes [13]. [14] developed a conceptual model explaining how consumers’ preexisting motives and transient

#### The Dot-Com Retail Continuum



<Figure 2. Degree of product variability in

e-commerce (Adapted from [13])>

emotions affect purchasing process, and [15] developed a conceptual model after taking into consideration the existence of variable product quality. According to his model, variable quality of a product decreases motive and emotion, two factors boosting e-royalty. In other words, as quality variability increases, consumers perceive higher uncertainty and this can result in no purchase. This chain action negatively affecting purchase intention was tested by [2].

In a pilot study conducted by [16], it is found that when purchasing products with variable quality, consumers prefer sellers who decrease uncertainty by providing enough information on product to those who sell at lower price but provide not enough product information. In the study, consumers preferred CDs (product with invariable quality) sold at lower price, but preferred agro-products (product with variable quality) which provide more useful information although they are sold at higher price [16].

Because of variable quality of agro-products, selecting agro-products requires looking and feeling. However, agro-products in current e-commerce transaction cannot satisfy consumers' desire to look and feel. Consumers feel higher uncertainty associated with purchasing of food than with other products and this is why the size of agro-product transaction is relatively small [17]. Therefore it can be expected that when e-commerce sites can express visually quality or taste of agro-products they sell, consumer uncertainty will decrease and increase consumer satisfaction to result in larger size of total agro-products transaction amount.

**Visualization of Taste**

While several efforts are made to visualize taste of food, use of taste visualization technique in e-commerce environment is rare. Examples include



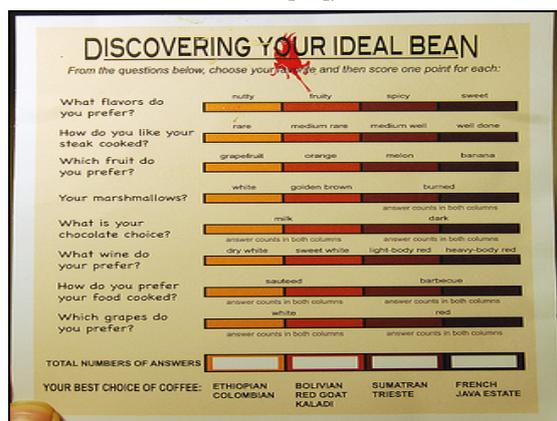
curry, beer, coffee, and Kimchi. They are shown in <figure 3>, <figure 4>, <figure 5>, <figure 6>, and <figure 7>.

<Figure 3. Visualization of Curry Taste (Adapted [26])>

Pungency	Description	Icon
mild	Soft and Mild	😊
Moderate	Standard	🙂
1 hot	A little hot	😬
2 hot	2 times	😬🔥
3 hot	3 times	😬🔥🔥
4 hot	very hot	😬🔥🔥🔥
5 hot	Extremely very hot	😬🔥🔥🔥🔥
6-10 hot	Unchallengeable	😬🔥🔥🔥🔥🔥

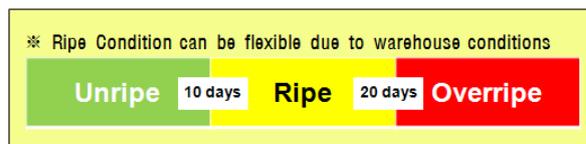
<Figure 4. Visualization of Curry Taste (Adapted

from [27])>



< Figure 6. Visualization of Coffee Taste (Adapted from [28])>

Projects to visualize taste of Kimchi, a traditional Korean food, are in progress. Diagram of <figure 7> set three stages of fermentation (non-fermented, moderate fermented, over-fermented) in continuum and provides fermentation date information to help consumers select Kimchi they want.



< Figure 7. Visualization of Kimchi Taste (Adapted from [29])>

In 2007, Korean Ministry of Food, Agriculture, Forestry and Fishery (MFAFF), as a part of its plan to standardize traditional food, has developed a standard for spiciness and fermentation rate of Kimchi. <Table 1> shows pungency information and <Table 2> shows fermentation stage (Ministry of Food 2007).

Pungency	Kimchi	
	Capsaicinoids contents (mg %)	SHU (scoville heat unit)
mild	<0.3	<45
slightly hot	0.3 - 1.5	45~200
moderate	1.5 - 3.0	200~450
very hot	3.0 - 4.5	450~600
extremely very hot	>4.5	>600

<Table 1. Pungency of Kimchi (Adapted from MFAFF)>

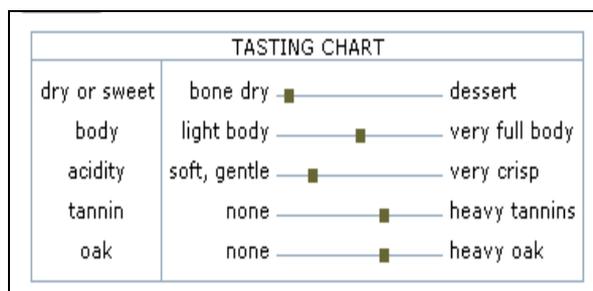
Fermentation grade	pH	Titratble acidity (lactic acid, %)
non-fermented	>5.0	<0.5
moderate fermented	4.2 - 5.0	1.0 - 0.6
over-fermented	<4.0	>1.0

<Table 2. Fermentation Grade of Kimchi

(Adapted from MIFAFF)>

This standardization not only provides specific information on Kimchi to meet diverse consumer groups, but also contributes in the increment of Kimchi export and hence an overall improvement of Kimchi industry. MIFAFF plans to lead industry to voluntarily adopt the standardization, and then apply the standardization to quality certification.

A good example of food visualization technique usage is Wine.com. <Figure 8> is the visualization chart used at Wine.com.



<Figure 8. Visualization table of wine.com

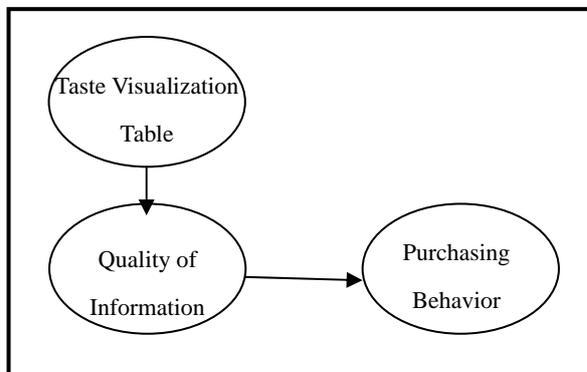
(Adapted from [30])>

Wine.com, an American website established in 2004, sells wine and appetizers served with wine to 50 states of the United States and Japan. Its visualization chart helps overcome inability to let consumers taste before purchase and the fact that wine-related information is difficult for some consumers to understand. This has helped in decreasing consumer uncertainty and also helped the company grow faster than its major competitors to enable it to acquire most of them.

### Research Design

This study develops taste visualization table, applies it to online shopping malls that sell agro-products, and investigate the difference in customer behavior before and after application of the table. Figure 9 is

the conceptual research model. Kimchi and Gochujang, two traditional Korean agro-products, have been chosen because the size of their transaction in e-commerce is relatively higher and consumers have diverse preference towards distinguishable features an individual product has.



<Figure 9. Research Model>

Elaboration Likelihood Model (ELM) is a model for analyzing factors that affect information process and changes in consumer attitude and behavior arising because of the factors [18], [19]. When awareness is happened by stimulus, it would lead to elaboration. And also it occurs behavior arising. Tam and Ho finds the similar model based on information procession for consumer decision and response like ELM [19]. According to the model, when a hypothesis is set, measured variables can be classified into awareness, recognition, decision and response, and feedback test the hypotheses by matching each variable to click stream measure items. Hypotheses are set according to the classification in <table 3>.

First, as visualization table can fulfil more senses, daily visit is expected to increase as a result of its inclusion. When a website visitor consecutively visits several pages in the website, one visit is recorded. When the same visitor visits the same website after certain amount of time, it is recorded as another visit. While there's no standard for the time between visits, the time commonly ranges between 15minutes and two hours and average is 30 minutes. Using visit as a variable instead of hit can prevent the problem of counting meaningless or accidental visits to a website [20].

*H1a: If taste visualization table is applied to a webpage on an online shopping mall that sells agro-products, daily visit to the page increases.*

*H1b: A web page with visualization table has higher percentage of daily visit increase than a web page without visualization table has.*

Also, number of search made on visualization related

keywords is expected to increase. The increase can be *webpage on an online shopping mall, the number of*

Measuring Variable	Measurement Item	Description
Awareness(H1)	Visit	Number of visits to items with visualization table
	Search Keywords	Number of search keywords related to visualization
Recognition(H2)	Visit Length	Time spent in a page where visualization table is inserted
	Revisit	Number of revisit to page where visualization table is inserted.
Decision and Response(H3)	Shopping Cart Storage	Number of items with visualization table stored in shopping carts.
	Transaction	Number of items with visualization table included in actual transaction.
	Revenue	Sales revenue on items with visualization table
Feedback(H4)	Customer Satisfaction	Relative customer satisfaction

**Table 3 – Measurement Items of visualization table**

interpreted as success in attracting consumer attention [20].

*H1c: If taste visualization table is applied to a webpage on an online shopping mall, the number of search made on visualization related words increases.*

Second, it is expected that average visit length of visitors might change after visualization table is applied.

*H2a: If taste visualization table is applied to a webpage on an online shopping mall, average visit length of visitors will change.*

*H2b: A web page with visualization table has larger average visit length change than a web page without visualization table has.*

Also the number of revisit is an important measurement item, which is related to recognition variable 'Stickiness'.

*H2c: If taste visualization table is applied to a webpage on an online shopping mall, the number of revisit increases.*

*H2d: A web page with visualization table has higher percentage of revisit increase than a web page without visualization table has.*

Third, items that can be measured in decision making process include shopping card storage, transaction, and revenue. When more storage, more transaction, or higher revenue are found for a product with visualization table, this can be interpreted as the function of consumer decision making process [19].

*H3a: If taste visualization table is applied to a*

*shopping cart storage increases.*

*H3b: A web page with visualization table has higher percentage of the number of shopping cart storage increase than a web page without visualization table has.*

*H3c: If taste visualization table is applied to a webpage on an online shopping mall, the number of transaction of the product increases.*

*H3d: A web page with visualization table has higher percentage of the number of transaction increase than a web page without visualization table has.*

*H3e: If taste visualization table is applied to a webpage on an online shopping mall, revenue increases.*

*H3f: A web page with visualization table has higher percentage of the revenue increase than a web page without visualization table has.*

According to [16], if a product sold online has heterogeneity, consumers are willing to pay price premium for products which provide high quality information. Based on this result, it is expected that if visualization table helps in increasing the quality information of agro-products which are heterogeneous.

*H4a: If taste visualization table is applied to a webpage on an online shopping mall, customer satisfaction increases.*

*H4b: A web page with visualization table has higher percentage of the customer satisfaction increase than a web page without visualization table has.*

## Research Method

### Click Stream Data

Click Stream data is a data on a path a user follows to visit a webpage and is used to understand

relationship between the paths. The data can be obtained from the

session, sessions per a user, and page visits per a user are collected. Number of users refers to the number

ID	Session ID	IP	Page Visited	Product Info.	Visit Length
1	1	210.*.* *	Home	-	30
2	1	210.*.* *	Category	-	26
3	1	210.*.* *	Product	G-08-110-01	81
4	1	210.*.* *	Account	-	7
5	1	210.*.* *	Cart	-	(25)

<Table 4 – Example of processed click stream data>

log on the server of web server or an institution that collects Internet surfing data sent by panels. Information that can be obtained from click stream data include address of visited webpage, address of previous webpage, browser used, duration of stay, etc. Data obtained from panels also contain demographic information [20].

Click stream data has been widely used in purpose of analyzing decision making on Internet. It has been used to understand path analysis and prediction within a website [5]. and identify purpose of website visit [22]. Visualization systems that help clearly understand the result of click stream data analysis has been developed [23] and whether a user will purchase a product in his/her subsequent visit has been analyzed [4]. Research on suggesting a product to a user after analyzing his/her path has been conducted [24], [25] and further research has been conducted to find out how effective the product suggestion is in affecting subsequent migration path and product visit pattern [20]. In this study, changes in user behavior will be analyzed after a taste visualization table has been included to provide more information on food.

### Data Collection

An online shopping mall that sells agro-products, 'KGFarm', is selected to examine the effect of adding visualization table. KGFarm is designed and maintained by the local government of Kyungkido, the largest province in Korea in terms of population. Sellers including large corporate, SMEs, and individual farmers place their product on KGFarm. Therefore for a customer, there are several sellers to choose among, based on price, product information and other preferences, when they want to buy a certain product.

Visualization tables will be placed on selected product pages and categorization pages will indicated which products have visualization table. For analysis, collection period, number of users, pages per a

of IPs which visited the web page and this excludes the IP of KGFarm employee and product seller. Session refers to a sequence of process of a user between initial visit and leave of the website. Page visits refers to the number of visited URL.

An example of collected raw click stream data processed into meaningful data is shown in <table 4>.

### Future Plan

The taste visualization charts of Kimchi and Gochujang are in development process based on preceding studies. After analyzing factors that determine the taste of Kimchi and Gochujang, evaluation criteria will be selected, and sensory evaluation by panels will be conducted. The process will take several months to complete.

Taste visualization tables will be inserted and the change of sales and customers' satisfaction in KGFarm will be investigated to prove the hypotheses. The existing sales and satisfaction of customers before implementation of the table in the same sites should also be measured. The customer satisfaction will be investigated through simple surveys with approval of KGFarm. Collected click stream data will be analyzed to test hypotheses.

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