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A Study on the Operation Method of Packaging System to Enhance Logistics Efficiency

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Abstract This study sought efficiency of collaboration between manufacturers and distributors by finding a way to improve logistics efficiency in order to save distribution cost and standardize packaging together with profit generation by way of simple-display packaging in discount stores. For the study purpose, the impact of products with RRP (Retail Ready Packaging) by each discount store on the collaboration achievement such as loading efficiency was observed. From this observation, an alternative packaging system that can improve logistics efficiency between manufacturers and distributors was sought and the role of distributors in distribution standardization was explored. The purpose of this study also includes suggesting some implications on future basic direction of environment-friendly management. If this study would induce distributors to have more interest in distribution standardization and if logistics efficiency would be enhanced by the operation of packaging system considered of compatibility with pallets, this study would have academic significance and create practical values.

Keywords RRP (Retail Ready Packaging), Packaging system, Logistics efficiency

Introduction

Pain[1] defined packaging as “the art, science, and technology of the goods prepared for transport or sales” and the Institute of Packaging (IOP) as the technique and process associated with the preparation for transporting, storing, and delivering goods or products to customers. Moreover, Gray[2] defined packaging as “a close combination of product policy and sales policy, which is an element of the merchandising policy that is fundamentally related to a consumer’s choice” and “a part of the marketing, just like advertising”. Packaging has been recognized as having a great impact on the logistics system and activities such as distribution, storage, and handling through the supply chain[3-5]. However, many package-dependent costs within the logistics system have been overlooked. As a result of calculation of the standard of RRP’s out box by A Manufacturer in Study on the Effects of Implementation of RRP on Load Efficiency through Manufacturers’ Packaging System, it was shown that the average palette load efficiency ratio was 77.1%[6]. Jung and Kim[3] compared and analyzed the packaging systems of general products and RRP products, and confirmed that their packaging systems are different, and noted that it was the results of the current RRR system considering only the efficiency of the stores of logistics companies. Therefore, packaging can affect the effectiveness of the supply chain because it influences the relationship among the supply chain, the major consumers of the packaging, and the end users. Although recent studies mainly evaluated the functionalities of the simple display in running a store[8,9], the literature review revealed that there have not been enough studies evaluating the packaging evaluation methodology from the viewpoint of logistics[10-13]. Therefore, it seems that methods and tools to evaluate the concept of packaging such as packaging system are required for both industry and academia. Discount Store in South Korea mainly seek new packaging concepts in order to increase the efficiency of store management from the aspect of merchandising such as retail ready package (RRP), case size reduction (CSR), and unification etc.[14] Among them, RRP is a packaging type that enhances the efficiency of the product transport and product display. It is a customer-oriented packaging type and helps customers browse products easily. ECR UK (2005) classifies packaging area into 3 sections. The first is UP (Unready Packaging) and the second RRP (Retail Ready Packaging). The third is classified as DP (Display Ready Packaging), a single unit packaging such as MU (Merchandising Unit), Dolly, etc. Accordingly, RRP is also an intermediate form of UP and DRP[15]. On the other hand, the importance of the efficiency of logistics is increasing for manufacturers. It is

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because the efficiency of logistics systems still has many obsta- cles to overcome even in advanced countries, although the productivity of the company has already been advanced considerably owing to the advancement of mechanization and automation[16-20]. These findings implied that manufacturers prioritize the safety and efficiency for the transportation of goods in regard to the form of product packaging while supermarkets place the most importance on the easiness and efficiency of sales promotion for increasing self-sales. Therefore, it is urgent to establish an alternative packaging system to prevent the degradation of the efficiency of logistics due to problems in the distribution process of RRP products.

Study Procedure and Methods

This study conducted a face-to-face interview before conducting the first survey in order to reflect the professional opinions of the practitioners. The items of the questionnaire were confirmed based on the results of the face-to-face interview. The first survey was conducted after creating a questionnaire composed of 16 items for a factor analysis. The second survey was prepared with items containing the same meaning and contents of the first survey in order to clarify the verification based on the results of the factor analysis on the questionnaire of the first survey. Moreover, a reliability analysis based on the results of the first analysis was conducted for the second survey. It was confirmed that it was possible to combine the results using the factors derived from the factor analysis of the first survey. This study was conducted using the results. It conducted frequency analysis, cross-analysis, and descriptive statistics for calculating the basic statistics of the collected responses for the second survey. Based on the results of the factor analysis conducted for the first survey, the reliability analysis was confirmed to secure the reliability of each subfactor. Furthermore, one-way ANOVA and t-test were carried out for each sub-factor and individual items to compare the mean of the characteristics of the respondents. Chi-square test was performed to test each item. Scheffe's test was used as a post-hoc analysis for the one-way ANOVA. Pearson correlation analysis was performed to evaluate the correlation of the sub-factors at an alpha level of 0.05. The study used both the online survey and face-to-face interview methods. The collected questionnaires were coded after checking errors and omissions in the records. SPSS 19.0 was used for conducting the factor analysis of the first survey and analyzing the second verification after refining the data.

Establishment of Study Model

1. Discussion on the SCM Efficiency of a Packaging System

(Study Model 1) The overall efficiency of the supply network will be improved if the design factor of packaging is an operation considering SCM aspect instead of prioritizing the efficiency of the store operation.

(Study Model 2) The efficiency of packaging containers and eliminating the differences in the perceptions related to a design factor between a manufacturer and a distributor will improve the overall efficiency of the supply network.

(Study Model 3) The RRP production facility in the manufacturer and the establishment of a process automation system will affect the improvement of the efficiency of logistics.

(Study Model 4) The packaging system and distribution process between a manufacturer and a distributor will affect logistics cost, environment, quality and safety.

(Study Model 5) The promotion of RRP through manufacturer's packaging system will improve the efficiency of logistics.

2. Discussion on the Partnership of a Packaging System

(Study Model 6) An objective checklist related to the operation of the packaging system will show a complementary function.

(Study Model 7) The establishment and operation of a consultative body related to the operation of a packaging system will have a positive impact on the improvement of the efficiency of logistics.

(Study Model 8) The establishment of a profit sharing and profit distribution system related to the packaging system operation will have a positive impact on the rational operation.

(Study Model 9) In the discount warehouse store, the pallet display pattern preferred by customers will affect the efficiency of logistics.

(Study Model 10) From the early stage of a new product preparation, the participation and feedback of the persons in charge of manufacturer’s packaging will improve the efficiency of logistics.

3. Discussion on the Institutional Aspect of a Packaging System

(Study Model 11) The mediator role of government and social organization regarding issues associated with the packaging system management will have a positive impact on rational operation.

(Study Model 12) The guideline that is prepared by collecting various opinions on the operation of a packaging system will positively affect the rational operation of the system.

(Study Model 13) The reasonable packaging system procedure to improve the efficiency of logistics and the willingness to comply with the system of logistics company’s relevant personnel related to the packaging design will positively affect the improvement in the efficiency of logistics.

Table 1. Composition of general samples

Classification		Number of Person	Percentage (%)	Classification		Number of Person	Percentage (%)
Question	1st Survey	156	35.3	Logistics	General	43	37.4
	2nd Survey	232	52.5		Expert	72	62.6
	3rd Survey	54	12.2		Total	115	100.0
	Total	442	100.0	Job (Specialized Field)	Company employee	370	83.7
Category of business	Manufacture	174	39.4		Researcher	38	8.6
	Retailer	153	34.6		Professor	34	7.7
	Logistics	115	26.0		Total	442	100.0
	Total	442	100.0	Position	manager	159	43.0
Manufacture	General	70	40.2		vice-chief	110	29.7
	Importer	64	36.8		Exaggeration	68	18.4
	PB	40	23.0		Agency	33	8.9
	Total	174	100.0		Total	370	100.0
Distributor	Discount Store	53	34.6	Period	3~10 Year	143	32.4
	M.W.C.	53	34.6		11~20 Year	248	56.1
	General	47	30.8		21~30 Year	51	11.5
	Total	153	100.0		Total	442	100.0
Consumer Job	Homemaker	114	64.4	Consumer Shopping Period	1~5 Year	52	29.4
	Company employee	38	21.5		6~10 Year	72	40.7
	Student	17	9.6		11~15 Year	43	24.3
	Official	8	4.5		16~25 Year	10	5.6
	Total	177	100.0		Total	177	100.0

Table 2. Results of variables' fitness and significant tests

Kaiser-Meyer-Olkin Test for Sampling Adequacy		0.880
Bartlett's Test of Sphericity	Approximation	2803.197
	Degree of Freedom	120
	p-value	0.000

4. Discussion on the Standardization of a Packaging System

(Study Model 14) The delivery system of the discount warehouse store considering the compatibility and consistency of ULS will improve the efficiency of logistics.

(Study Model 15) The recognition and utilization of KS T 1002 will improve the efficiency of loading.

(Study Model 16) The standardization of RRP display shelves will improve the efficiency of loading.

Analysis and Verification of Study Models

1. Results of Survey Analysis

1) Population and Survey Contents

The 156 copies of the first questionnaire were collected and the 232 copies of the second questionnaire were collected. The samples of the second survey were composed as shown in (Table 1) so the range of the population could be maintained as consistent with the population range of the first survey.

2) Factor Analysis

The KMO value for the factor analysis of this study was 0.880 (Table 2). Therefore, it was confirmed that the measurement variables were appropriate for the factor analysis. Moreover, Bartlett's test of sphericity was conducted in order to find out whether the variables used in the factor analysis was statistically correlated or not. It was found that the p-value was 0.000 so it was proven that the factors were significantly correlated.

As shown from the total variance explained by a factor analysis (Table 3), the cumulative percentage derived by the factors was 84.966%. Therefore, it was determined that the derived factors sufficiently explained the results of this study.

A factor analysis was conducted on the coded questionnaire results by using VARIMAX rotation method, which is one of principle component analysis (PCA) methods and assumes

Table 3. Explained total variance

Component	Initial Eigenvalue			Summed Load of Extract Squared			Sum of Rotation Squared		
	Total	% Variance	% Load	Total	% Variance	% Load	Total	% Variance	% Load
1	9.350	58.437	58.437	9.350	58.437	58.437	3.992	24.950	24.950
2	1.960	12.252	70.689	1.960	12.252	70.689	3.943	24.645	49.595
3	1.263	7.896	78.585	1.263	7.896	78.585	2.878	17.986	67.581
4	1.026	6.410	84.996	1.026	6.410	84.996	2.786	17.415	84.996
5	0.504	3.148	88.144						
6	0.410	2.560	90.703						
7	0.299	1.866	92.569						
8	0.226	1.413	93.983						
9	0.200	1.250	95.233						
10	0.180	1.122	96.355						
11	0.146	0.914	97.269						
12	0.120	0.749	98.018						
13	0.112	0.697	98.715						
14	0.090	0.565	99.280						
15	0.071	0.441	99.721						
16	0.045	0.279	100.000						

Table 4. Results of factor analysis

Classification	Component				Variable Contents
	1	2	3	4	
VAR00003	.846	.231	.198	.138	Problems associated with pursuing the efficiency in operating a store
VAR00002	.837	.269	.057	.192	Problems caused by the difference in recognition between groups (i.e., manufacturers and distributors)
VAR00004	.821	.224	.004	.101	Problems due to the lack of automation of RRP production facilities and processes
VAR00001	.812	.219	.222	.276	Increased logistics costs and problems associated with the environment, quality, and safety
VAR00011	.742	.329	.212	.226	Problems related to the RRP packaging design processes
VAR00007	.288	.835	.252	.222	Problems due to the lack of Check List for complementing each other
VAR00006	.359	.821	.280	.141	Problems due to the lack of a consultative body for conducting RRP
VAR00008	.246	.802	.314	.220	Problems due to the insufficient and uneven distribution of benefits
VAR00005	.302	.749	.188	.289	Problems of decreasing the loading efficiency of pallet due to the DRP pattern
VAR00009	.297	.743	.251	.260	Problems of reflecting insufficient feedback of persons in charge of packaging of the initial manufacturer
VAR00016	.188	.249	.877	.213	Problems due to inadequate mediator roles of government and social organizations
VAR00015	.135	.298	.875	.183	Problems due to the lack of proper guidelines
VAR00014	.125	.327	.830	.310	Problems associated with the lack of the will of people to improve the efficiency of logistics
VAR00013	.286	.229	.202	.864	Problems due to the insufficient compatibility and consistency of ULS
VAR00010	.217	.214	.234	.858	Problems due to the lack of KS T 1002 recognition and utilization
VAR00012	.211	.359	.289	.816	Problems due to the insufficient standardization of RRP display shelf standard

independence between factors. It was confirmed that factors were grouped into four principle components (Table 4).

First, factor 1 is the problem of SCM efficiency, factor 2 was the problems of partnership, factor 3 was the problems associated with institutional aspects, and factor 4 was the problems of standardization (Table 5).

The results of the reliability test showed that Cronbach's α coefficient was 0.951, indicating very high reliability. Therefore, it was concluded that the results of the survey reflected the contents of the survey adequately (Table 6).

Table 5. Definition of variables according to common factors

Factor Configuration	Configuration Variables	Definition of Configuration Variables
Factor 1	Problems due to the pursuit of efficiency first in operating a store	Problem of SCM efficiency
	Problems due to the differences in recognition between groups (i.e., manufacturers and retailers)	
	Problems due to the lack of automation of RRP production facilities and processes	
	Increased logistics costs and problems associated with the environment, quality, and safety	
	Problems related to the RRP packaging design processes	
Factor 2	Problems due to the lack of check list for complementing each other	Problems of partnership
	Problems due to the lack of a consultative body for conducting RRP	
	Problems due to the insufficient and uneven distribution of benefits	
	Problems of decreasing the loading efficiency of pallet due to the DRP pattern	
	Problems of reflecting insufficient feedback of persons in charge of packaging of the initial manufacturer	
Factor 3	Problems due to inadequate mediator roles of government and social organizations	Problems associated with institutional aspects
	Problems due to the lack of proper guidelines	
	Problems associated with the lack of the will of people to improve the efficiency of logistics	
Factor 4	Problems due to the insufficient compatibility and consistency of ULS	Problems of standardization
	Problems due to the lack of KS T 1002 recognition and utilization	
	Problems due to the insufficient standardization of RRP display shelf standard	

Table 6. Reliability statistics

Cronbach's α	Item Number
0.951	16

Table 7. Item statistics

Classification	Mean	Standard Deviation	N	Variable Contents
VAR00001	4.9679	1.22036	156	Increased logistics costs and problems associated with the environment, quality, and safety
VAR00002	5.3654	1.20261	156	Problems due to the differences in recognition between groups (i.e., manufacturers and retailers)
VAR00003	5.1859	1.30411	156	Problems due to the pursuit of efficiency first in operating a store
VAR00004	4.9936	1.28262	156	Problems due to the lack of automation of RRP production facilities and processes
VAR00005	4.7372	1.39636	156	Problems of decreasing the loading efficiency of pallet due to the DRP pattern
VAR00006	4.5256	1.51742	156	Problems due to the lack of a consultative body for conducting RRP
VAR00007	4.4808	1.46120	156	Problems due to the lack of check list for complementing each other
VAR00008	4.6218	1.58356	156	Problems due to the insufficient and uneven distribution of benefits
VAR00009	4.8333	1.33360	156	Problems of reflecting insufficient feedback of persons in charge of packaging of the initial manufacturer
VAR00010	4.2308	1.42261	156	Problems due to the lack of KS T 1002 recognition and utilization
VAR00011	5.0256	1.36287	156	Problems related to the RRP packaging design processes
VAR00012	4.3013	1.56337	156	Problems due to the insufficient standardization of RRP display shelf standard
VAR00013	4.3397	1.52610	156	Problems due to the insufficient compatibility and consistency of ULS
VAR00014	4.4231	1.65408	156	Problems associated with the lack of the will of people to improve the efficiency of logistics
VAR00015	4.1923	1.55383	156	Problems due to the lack of proper guidelines
VAR00016	4.4423	1.74593	156	Problems due to inadequate mediator roles of government and social organizations

Table 8. Total item statistics

Classification	Mean scale when an item is deleted	Variance of scale when an item is deleted	Adjusted Items – Total Correlation	Cronbach's α when an item is deleted
VAR00001	69.6987	280.483	0.737	0.948
VAR00002	69.3013	283.876	0.660	0.949
VAR00003	69.4808	280.638	0.681	0.949
VAR00004	69.6731	286.312	0.556	0.951
VAR00005	69.9295	274.634	0.767	0.947
VAR00006	70.1410	269.077	0.818	0.946
VAR00007	70.1859	270.978	0.810	0.946
VAR00008	70.0449	268.327	0.795	0.946
VAR00009	69.8333	275.985	0.775	0.947
VAR00010	70.4359	277.847	0.679	0.949
VAR00011	69.6410	276.928	0.734	0.948
VAR00012	70.3654	269.911	0.773	0.947
VAR00013	70.3269	273.744	0.713	0.948
VAR00014	70.2436	269.811	0.728	0.948
VAR00015	70.4744	274.857	0.676	0.949
VAR00016	70.2244	269.543	0.689	0.949

Table 9. Measurements of RRP's recognition according to the respondent's characteristics (Manufacturer: a, Distributor: b, and Logistics: c)

Classification	N	Mean	Standard Deviation	F (p-value)	Scheffe
Manufacture	101	4.41	0.494	5.191** (0.006)	c<b=a
Distributor	71	4.35	0.481		
Logistics	60	4.17	0.376		

*p<0.05, **p<0.01, ***p<0.001.

Table 10. Results of a reliability analysis on the second survey

Classification	Cronbach's α	Item Number
SCM efficiency	0.632	5
Partnership	0.884	5
Institutional Aspect	0.797	3
Standardization	0.865	3

Table 11. Results of comparing means of business standards for sub-factors (Manufacturer: a, Distributor: b, and Logistics: c)

Factor	Classification	N	Mean	Standard Deviation	F (p-value)	Scheffe
SCM efficiency	Manufacture	101	3.90	0.33	53.900*** (0.000)	b<c<a
	Distributor	71	3.33	0.39		
	Logistics	60	3.74	0.35		
Partnership	Manufacture	101	3.96	0.35	96.973*** (0.000)	b<a=c
	Distributor	71	3.21	0.48		
	Logistics	60	4.03	0.32		
Institutional Aspect	Manufacture	101	4.12	0.33	104.298*** (0.000)	b<a=c
	Distributor	71	3.35	0.38		
	Logistics	60	4.06	0.40		
Standardization	Manufacture	101	4.05	0.33	137.170*** (0.000)	b<a=c
	Distributor	71	3.14	0.49		
	Logistics	60	3.98	0.28		

*p<0.05, **p<0.01, ***p<0.001.

The descriptive statistical analysis can predict the items with great impact and those with relatively low impact among the 16 items (Table 7).

Even Cronbach's α value after deleting items showed that α values of all 16 items were higher than 0.9 (Table 8), and that reliability verification values were high without items to delete.

3) Reliability Analysis

The results is shown in (Table 9), (Table 10), and (Table 11).

4) Correlation Analysis

Pearson's correlation analysis was conducted to identify the relationships among sub-factors. It was found that all variables were significantly (p<0.001) correlated (Table 12).

5) One-Way ANOVA and Scheffe post-hoc analysis

The results of Scheffe post-hoc analysis showed that the means of all items were statistically significantly different from each other.

2. Verification of Study Models

Chi-square test was carried out for each measurement variable to verify the 16 study models set for this study. The results of verification are as follows.

Table 12. Results of Pearson's correlation analysis for sub-factors

Classification		SCM efficiency	Partnership	Institutional Aspect	Standardization
SCM efficiency	Pearson correlation coefficient	1	0.725***	0.611***	0.658***
	p-value (two-tails)		0.000	0.000	0.000
	N	232	232	232	232
Partnership	Pearson correlation coefficient	0.725***	1	0.752***	0.764***
	p-value (two-tails)	0.000		0.000	0.000
	N	232	232	232	232
Institutional Aspect	Pearson correlation coefficient	0.611***	0.752***	1	0.759***
	p-value (two-tails)	0.000	0.000		0.000
	N	232	232	232	232
Standardization	Pearson correlation coefficient	0.658***	0.764***	0.759***	1
	p-value (two-tails)	0.000	0.000	0.000	
	N	232	232	232	232

*p<0.05, **p<0.01, ***p<0.001.

Table 13. Results of one-way ANOVA

Variable	Business Type	N	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Minimum	Maximum		
SCM efficiency 1	Manufacture	101	4.31	0.524	0.052	4.20	4.41	3	5
	Distributor	71	2.94	0.475	0.056	2.83	3.06	2	4
	Logistics	60	4.17	0.526	0.068	4.03	4.30	3	5
	Total	232	3.85	0.792	0.052	3.75	3.96	2	5
SCM efficiency 2	Manufacture	101	4.23	0.719	0.072	4.09	4.37	2	5
	Distributor	71	3.94	0.475	0.056	3.83	4.06	3	5
	Logistics	60	4.18	0.469	0.061	4.06	4.30	3	5
	Total	232	4.13	0.603	0.040	4.05	4.21	2	5
SCM efficiency 3	Manufacture	101	2.98	0.693	0.069	2.84	3.12	2	5
	Distributor	71	3.72	0.614	0.073	3.57	3.86	3	5
	Logistics	60	3.03	0.663	0.086	2.86	3.20	2	4
	Total	232	3.22	0.738	0.048	3.12	3.32	2	5
SCM efficiency 4	Manufacture	101	4.05	0.433	0.043	3.96	4.13	3	5
	Distributor	71	3.06	0.333	0.040	2.98	3.14	2	4
	Logistics	60	3.48	0.725	0.094	3.30	3.67	2	4
	Total	232	3.60	0.657	0.043	3.51	3.68	2	5

Table 13. Results of one-way ANOVA (Continued)

Variable	Business Type	N	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Minimum	Maximum		
SSCM efficiency 5	Manufacture	101	3.93	0.354	0.035	3.86	4.00	3	5
	Distributor	71	3.00	0.414	0.049	2.90	3.10	2	4
	Logistics	60	3.85	0.360	0.046	3.76	3.94	3	4
	Total	232	3.63	0.560	0.037	3.55	3.70	2	5
Partnership 1	Manufacture	101	4.10	0.387	0.039	4.02	4.18	3	5
	Distributor	71	3.34	0.559	0.066	3.21	3.47	2	4
	Logistics	60	4.28	0.454	0.059	4.17	4.40	4	5
	Total	232	3.91	0.604	0.040	3.84	3.99	2	5
Partnership 2	Manufacture	101	4.12	0.407	0.041	4.04	4.20	3	5
	Distributor	71	3.35	0.481	0.057	3.24	3.47	3	4
	Logistics	60	4.12	0.324	0.042	4.03	4.20	4	5
	Total	232	3.88	0.542	0.036	3.81	3.95	3	5
Partnership 3	Manufacture	101	4.11	0.615	0.061	3.99	4.23	2	5
	Distributor	71	3.28	0.590	0.070	3.14	3.42	2	4
	Logistics	60	4.32	0.504	0.065	4.19	4.45	3	5
	Total	232	3.91	0.718	0.047	3.82	4.00	2	5
Partnership 4	Manufacture	101	3.18	0.639	0.064	3.05	3.30	2	5
	Distributor	71	2.76	0.547	0.065	2.63	2.89	2	4
	Logistics	60	3.08	0.591	0.076	2.93	3.24	2	4
	Total		3.03	0.624	0.041	2.95	3.11	2	5
Partnership 5	Manufacture	101	4.29	0.535	0.053	4.18	4.39	3	5
	Distributor	71	3.34	0.533	0.063	3.21	3.46	2	4
	Logistics	60	4.37	0.520	0.067	4.23	4.50	3	5
	Total	232	4.02	0.696	0.046	3.93	4.11	2	5
Institutional Aspect 1	Manufacture	101	3.98	0.346	0.034	3.91	4.05	3	5
	Distributor	71	2.94	0.410	0.049	2.85	3.04	2	4
	Logistics	60	3.87	0.536	0.069	3.73	4.01	3	5
	Total	232	3.63	0.624	0.041	3.55	3.71	2	5
Institutional Aspect 2	Manufacture	101	4.07	0.406	0.040	3.99	4.15	3	5
	Distributor	71	3.34	0.533	0.063	3.21	3.46	2	4
	Logistics	60	4.00	0.368	0.048	3.90	4.10	3	5
	Total	232	3.83	0.547	0.036	3.76	3.90	2	5
Institutional Aspect 3	Manufacture	101	4.30	0.625	0.062	4.17	4.42	3	5
	Distributor	71	3.76	0.430	0.051	3.66	3.86	3	4
	Logistics	60	4.30	0.561	0.072	4.15	4.45	3	5
	Total	232	4.13	0.606	0.040	4.06	4.21	3	5
Standardization 1	Manufacture	101	4.19	0.542	0.054	4.08	4.30	3	5
	Distributor	71	3.13	0.505	0.060	3.01	3.25	2	4
	Logistics	60	4.07	0.607	0.078	3.91	4.22	3	5
	Total	232	3.83	0.722	0.047	3.74	3.93	2	5
Standardization 2	Manufacture	101	3.91	0.349	0.035	3.84	3.98	3	5
	Distributor	71	3.15	0.525	0.062	3.03	3.28	2	4
	Logistics	60	3.82	0.390	0.050	3.72	3.92	3	4
	Total	232	3.66	0.536	0.035	3.59	3.72	2	5
Standardization 3	Manufacture	101	4.04	0.398	0.040	3.96	4.12	3	5
	Distributor	71	3.13	0.559	0.066	2.99	3.26	2	4
	Logistics	60	4.05	0.287	0.037	3.98	4.12	3	5
	Total	232	3.76	0.603	0.040	3.68	3.84	2	5

Table 14. Results of Scheffe post-hoc analysis (Manufacturer: a, Distributor: b, and Logistics: c)

Variable	Business Type	N	Mean	Standard Deviation	F (p-value)	Scheffe
SCM efficiency 1	Manufacture	101	4.31	0.524	164.131*** (0.000)	b<c=a
	Distributor	71	2.94	0.475		
	Logistics	60	4.17	0.526		
SCM efficiency 2	Manufacture	101	4.23	0.719	5.120** (0.007)	c<a, b
	Distributor	71	3.94	0.475		
	Logistics	60	4.18	0.469		
SCM efficiency 3	Manufacture	101	2.98	0.693	29.155*** 0.000	a=c<b
	Distributor	71	3.72	0.614		
	Logistics	60	3.03	0.663		
SCM efficiency 4	Manufacture	101	4.05	0.433	84.036*** (0.000)	b<c<a
	Distributor	71	3.06	0.333		
	Logistics	60	3.48	0.725		
SCM efficiency 5	Manufacture	101	3.93	0.354	143.140*** (0.000)	b<c=a
	Distributor	71	3.00	0.414		
	Logistics	60	3.85	0.360		
Partnership 1	Manufacture	101	4.10	0.387	82.107*** (0.000)	b<a=c
	Distributor	71	3.34	0.559		
	Logistics	60	4.28	0.454		
Partnership 2	Manufacture	101	4.12	0.407	84.955*** (0.000)	b<a=c
	Distributor	71	3.35	0.481		
	Logistics	60	4.12	0.324		
Partnership 3	Manufacture	101	4.11	0.615	62.254*** (0.000)	b<a=c
	Distributor	71	3.28	0.590		
	Logistics	60	4.32	0.504		
Partnership 4	Manufacture	101	3.18	0.639	10.489*** (0.000)	b<c=a
	Distributor	71	2.76	0.547		
	Logistics	60	3.08	0.591		
Partnership 5	Manufacture	101	4.29	0.535	84.218*** (0.000)	b<a=c
	Distributor	71	3.34	0.533		
	Logistics	60	4.37	0.520		
Institutional Aspect 1	Manufacture	101	3.98	0.346	138.491*** (0.000)	b<c=a
	Distributor	71	2.94	0.410		
	Logistics	60	3.87	0.536		
Institutional Aspect 2	Manufacture	101	4.07	0.406	63.697*** (0.000)	b<c=a
	Distributor	71	3.34	0.533		
	Logistics	60	4.00	0.368		
Institutional Aspect 3	Manufacture	101	4.30	0.625	23.087*** (0.000)	b<a=c
	Distributor	71	3.76	0.430		
	Logistics	60	4.30	0.561		
Standardization 1	Manufacture	101	4.19	0.542	85.314*** (0.000)	b<c=a
	Distributor	71	3.13	0.505		
	Logistics	60	4.07	0.607		
Standardization 2	Manufacture	101	3.91	0.349	73.369*** (0.000)	b<c=a
	Distributor	71	3.15	0.525		
	Logistics	60	3.82	0.390		
Standardization 3	Manufacture	101	4.04	0.398	111.432*** (0.000)	b<a=c
	Distributor	71	3.13	0.559		
	Logistics	60	4.05	0.287		

*p<0.05, **p<0.01, ***p<0.001.

Table 15. Results of the overall Chi-square test

Study Model	Verification	χ^2 (p-value)
Study Model 1	The overall efficiency of the supply network will be improved if the design factor of packaging is an operation considering SCM aspect instead of prioritizing the efficiency of the store operation.	178.500*** (0.000)
Study Model 2	The efficiency of packaging containers and eliminating the differences in the perceptions related to a design factor between a manufacturer and a distributor will improve the overall efficiency of the supply network.	32.675*** (0.000)
Study Model 3	The RRP production facility in the manufacturer and the establishment of a process automation system will affect the improvement of the efficiency of logistics.	49.107*** (0.000)
Study Model 4	The packaging system and distribution process between a manufacturer and a distributor will affect logistics cost, environment and quality and safety.	152.606*** (0.000)
Study Model 5	The promotion of RRP through manufacturer's packaging system will improve the efficiency of logistics.	140.133*** (0.000)
Study Model 6	An objective checklist related to the operation of the packaging system will show a complementary function.	121.864*** (0.000)
Study Model 7	The establishment and operation of a consultative body related to the operation of a packaging system will have a positive impact on the improvement of the efficiency of logistics.	120.068*** (0.000)
Study Model 8	The establishment of a profit sharing and profit distribution system related to the packaging system operation will have a positive impact on the rational operation.	106.730*** (0.000)
Study Model 9	The establishment of a profit sharing and profit distribution system related to the packaging system operation will have a positive impact on the rational operation.	23.258*** (0.001)
Study Model 10	From the early stage of a new product preparation, the participation and feedback of the persons in charge of manufacturer's packaging will improve the efficiency of logistics.	114.422*** (0.000)
Study Model 11	The mediator role of government and social organization regarding issues associated with the packaging system management will have a positive impact on rational operation.	148.916*** (0.000)
Study Model 12	The guideline that is prepared by collecting various opinions on the operation of a packaging system will positively affect the rational operation of the system.	95.781*** (0.000)
Study Model 13	The reasonable packaging system procedure to improve the efficiency of logistics and the willingness to comply with the system of logistics company's relevant personnel related to the packaging design will positively affect the improvement in the efficiency of logistics.	41.625*** (0.000)
Study Model 14	The delivery system of the discount warehouse store considering the compatibility and consistency of ULS will improve the efficiency of logistics.	117.483*** (0.000)
Study Model 15	The recognition and utilization of KS T 1002 will improve the efficiency of loading.	95.158*** (0.000)
Study Model 16	The standardization of RRP display shelves will improve the efficiency of loading.	136.882*** (0.000)

*p<0.05, **p<0.01, ***p<0.001.

3. Implication Based on the Results of Study Model Verification

Study Model 1 showed that the efficiency of logistics could be reduced when the packaging is composed by prioritizing the efficiency of shop operation. It was indicated that the efficiency of logistics would be improved when a packaging system is operated by considering the overall efficiency of the supply network. It can be said that it is necessary to establish an organic cooperation system between the parties and to complement the institutional aspect to support mutually beneficial management in order to manage a packaging system rationally based on the results of (Study Model 2). Study Model 3 confirmed that the efforts to reduce SKU could facilitate the introduction of automation to manufacturing facilities and processes in the future. Study Model 4 implied that the diverse entities constituting the supply network should make various efforts to reduce social costs and complement institutions in diverse aspects. The results of Study Model 5 explained that the establishment of a packaging process would have a positive impact on the efficiency of SCM regardless of the process of any industry. Furthermore, the results implied that collaboration would be needed in terms of the partnership. Study Model 6 suggested that it should be required to prepare a checklist which reflects broad opinions of government, social organizations, distributors, manufacturers and logistics companies to improve the efficiency of logistics. Research Model 6 suggests that a checklist should be prepared that collects broad opinions from government and social organizations, dis-

tributors, manufacturers, and logistics companies to improve logistics efficiency. Study Model 7 implied that manufacturers, distributors, and consumers could share profits only when these entities composed a consultative body and applied a new package design concept adequately that could create a win-win situation through collaboration. Study Model 8 suggested that it should be possible to practice a win-win management between distributors and manufacturers by establishing a system that shares and distributes profits owing to RRP. The results of Study Model 9 implied that the pallet display pattern preferred by customers and the efficiency of logistics should be considered at the same time. Study Model 10 confirmed that the efficiency of logistics would be improved if the opinions of people in charge of manufacturers' packaging could be reflected from the early stage. The results of Study Model 11 suggested that government and social organizations should need to identify issues related to packaging systems between the manufacturers and distributors and show the willingness to mediate these issues. The results of Study Model 12 showed that the guideline for the rational operation of a packaging system could contribute to resolving differences in recognition between distributors and manufacturers. Study Model 13 confirmed that it would be necessary to review policy support and tax relief such as rewards and certificate systems for distributors and stakeholders contributing to improving the efficiency of logistics. The results of Study Model 14 indicated that, in the case of RRP, the compatibility of ULS and the willingness to comply with consistency were very important issues. The results of Study Model 15 implied that the adaptation and usage of KS T 1002 could improve the efficiency of loading in many workplaces. However, the results of the one-way ANOVA test showed that it' rate was 3.66%, which was lower than the overall mean. It can be interpreted as the presence of limitations in the utilization of standards because people felt there were too many complex standards. The results of Study Model 16 confirmed that the compatibility of pallet could be secured by standardizing the RRP display shelves of supermarkets.

Conclusion

The present paper conducted research on an operation method for a packaging system for improving the efficiency of logistics between manufacturers and distributors, whose relevant studies have been limited. This study aimed to present an operation method of a packaging system for improving the efficiency of logistics between manufacturers and distributors in the future by identifying the problems and improvements associated with the packaging system between manufacturers and distributors through RRP and deriving solutions and action plans. The study conducted a chi-square analysis for 16 validation items, which were set to meet the study objectives. The results showed that all validation items were statistically significant (p<0.001). The results obtained from the verification of each item can be summarized as follows.

The test results on the efficiency aspect of SCM revealed that the packaging system or a delivery system that prioritizing the efficiency of a store operation would decrease the efficiency of logistics (χ^2=178.500, p<0.001). The analysis results showed that the efficiency of logistics would be improved by having manufacturers participate in the process and considering the overall efficiency of the supply network so that products are configurable by an established process such as a loading efficiency simulation with maintaining the compatibility between the out-box specifications of the product and the pallet while a distributor plans a new product (χ^2=140.133, p< 0.001). It was also confirmed that it would be required to reduce SKU by considering the specifications of display shelves and pallets in the many products and a small quantity of RRP pattern so it would be easy to establish the RRP production facilities in the facilities of manufacturers and the automation of processes (χ^2=49.107, p<0.001). Additionally, the efficiency of SCM should be improved and, at the same time, the partnership should be enhanced to reduce the disparity in viewpoints between manufacturers and distributors.

When the partnership aspect was examined, the presence of a mutual checklist could complement the functions of both parties objectively and rationally (χ^2=121.864, p<0.001). Moreover, the establishment and operation of a consultative body related to a packaging system could contribute to resolving the differences in recognition (χ^2=120.068, p<0.001). Moreover, RRP could contribute to the win-win management by establishing a system of sharing and distributing profits (χ^2=106.730, p<0.001). It is clear that the efficiency of logistics will be improved if people in charge of the manufacturers' packaging participate in the early stage of the new product development by enhancing partnership and if opinions for increasing the efficiency of loading such as specifications considering the compatibility with a pallet are reflected (χ^2=114.422, p<0.001).

The test of the institutional aspect showed that playing a mediator role of the government and social organizations would be needed to resolve issues (χ^2=148.916, p<0.001). Moreover, the guideline reflecting diverse opinions would be essential for operating a packaging system rationally. Additionally, it would be required to complement the institutions so people could have the willingness to improve the efficiency of logistics (χ^2= 95.781, p<0.001). The results of this study showed that the manufacturers and the distributors clearly have different perspectives, which caused issues related to operating a packaging system. If even efforts to identify issues are not given despite those related to the packaging system existing, it may result in social issues as the conflicts between the manufacturers and the distributors will be exacerbated. On the other hand, the contribution to improving the efficiency of logistics needs an

approach in the institutional aspect and positive complements regarding the packaging system operation between manufacturers and distributors in the context that there are no incentives, etc. (χ^2=41.625, p<0.001).

The results of the standardization aspect confirmed that the transshipment during the delivery of MWC products could reduce the efficiency of logistics (χ^2=117.483, p<0.001). The results also revealed that the efficiency of pallet loading increased when KS T 1002 was acknowledged and used (χ^2=95.158, p<0.001). However, when the specification of the display shelf could not use the specifications of KS T 1002, it could reduce the efficiency of standard pallet loading (χ^2=136.882, p<0.001). However, the results of one-way ANOVA in the second survey related to KS T 1002 specifications showed the lowest mean among the factors of the standardization aspect. Therefore, the results of this study implied that KS T 1002 should be simplified because the specifications defined in the current KS T 1002 are very diverse and too complex to use in practice. Finally, this study failed to handle a logistics packaging system connected with RRP and ICT with reference to SMART PACKAGING and SMART SHELF, and this problem would have to be complemented in the future research and should move in the progressive direction.

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