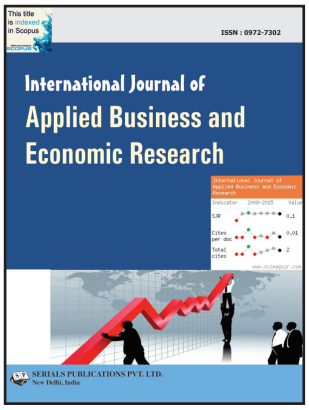

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A Study on Agency Sales Promotion of Distribution Channels by Using Clustering Analysis – The Case of Medical Device Company

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ABSTRACT

The purpose of this research is to search methods to improve sales of B2B small and medium companies whose utilization of information system is insufficient based on their limited data resources. To achieve this purpose, the agencies of a Korea-based foreign company were clustered using monthly sales data by agency, and products and strategies for each cluster were established for higher sales. The analysis was done using SPSS 18.0, and As a result of the clustering analysis of agencies using K-means clustering, the agencies were classified into 4 clusters. As a results, Cluster 1 showed the highest central value with KRW 8.74 billion in sales on average, followed by cluster 2 with KRW 5.05 billion, cluster 3 with KRW 2.22 billion, and cluster 4 with KRW 0.13 billion. Cluster 1 has 2 agencies, cluster 2, 11 agencies, cluster 3, 17 agencies, and cluster 4, 255 agencies; the distribution of agencies of each cluster was not consistent because clusters 1, 2, and 3 are agencies under exclusive contract with company A, and their sales of specific products are high; the rest of the agencies are complex-type agencies that sell products of 1 ~ 3 companies, and their sales of company A's products are not so high. This research suggests a new method with which small and medium B2B companies as manufacturers can support their authorized agencies — their key sales channels — for the growth of sales by classifying the agencies and analyzing their sales features through clustering analysis on the accumulated sales data of the agencies.

Keywords: Distribution Channel, Agency sales, Cluster Analysis, Medical Device Industry.

1. INTRODUCTION

An information system refers to the collection, processing, analysis, and distribution of information through input and output for specific purposes. Through the information system, businesses utilize information on their sales and diverse kinds of information generated from their business activities for better decision

making and higher efficiency. The development of the information system has been expanding its utilization scope to customer behavior prediction, trend analysis, etc., using not just structured data within the business but also unstructured data created from outside social network services (Turban, 2007, Lee, 2014).

Unlike the development of general information systems and expansion of business utilization scopes, the utilization scopes of individual companies actually vary considerably according to their levels of established information system and characteristics. This is more evident in small and medium companies. In particular, B2B (business to business) small and medium companies utilize the system only for their personnel and financing in a limited way, whereas B2C (business to customer) companies use it to make decisions through structured and unstructured data; depending on the company type, the utilization scope is limited. Thus, companies under these circumstances use limited structured data for making decisions.

Company A, the target of this research, shows the case very clearly. The company is a foreign medical device manufacturer, but its Korean branch is being operated independently; it is conducting distribution and sales activities through authorized dealers and related retailing market management, calling itself a B2B company. Accordingly, data that can be secured by the company are limited to the sales volume of the agencies.

Thus, this study started from the question on how B2B small and medium companies utilize their accumulated sales data and structured data related to their authorized franchises. After classifying agencies according to their characteristics using cluster analysis for the sales growth of the agencies and promotion of agencies with lower sales, strategies for improving the sales of the agencies were established.

The rest of this research is organized as follows: Chapter 2. Research on agency sales promotion and current status and features of the medical device industry; Chapter 3. Research process and references; Chapter 4. Research results, and Chapter 5. Conclusion.

2. LITERATURE REVIEW

Agency Sales Promotion

All marketing activities are performed to generate sales. Promotion, a communication method with customers, is used to stimulate demand for products as a marketing activity for higher sales of agencies; B2B promotion is aimed at communicating with diverse targets existing in the distributions structure and can be regarded as building an image different from one's rivals (Jeon et. al., 2011).

The main promotion method adopted by manufacturers is lower prices for higher sales of agencies, and prices reduction can be done by reduction for purchase (off-invoice deduction) or rebate of purchased amount during price reduction periods; promotion can be called an irregular marketing encouragement method devised to wield impact on the behavior of the channel members (Van Waterschoot & Van den Bulte, 1992). Moreover, promotion means the special incentive provided by manufacturers to members of the product distribution channel in the form of price reduction, free products, etc.; the members involved in the product distribution process can sell products to customers by making the products of the manufacturers

part of their product sales line through financial and physical promotion from the manufacturers (Blattberg & Levin, 1987).

Woo (2013) conceptualized the quality of services of Korean small and medium companies and stated that quality of services draws satisfaction from the relationship between B2B companies and direct and indirect relations among each component from the serial process, particularly satisfaction with relation and relational accomplishment from their transactions .

Among research studies on the growth of sales of agencies, studies on the promotion of sales have been done in diverse directions, Note, however, that research has not been actively conducted regarding the promotion of sales from the classification of agencies through cluster analysis for the growth of sales and activation of agencies with lower sales by utilizing accumulated sales data and structured data of agencies of small and medium companies.

Features and Current Status of the Korean Medical Device Industry

Medical devices are directly related to human life, but the parts account for a comparatively low percentage of the prices of total equipment, and they do not need a large amount of materials. Thus, the industry can save resources. Moreover, since it is a brain-intensive industry that requires highly developed technologies, it needs high precision and safety as a high-value, hi-tech industry. High medical level in related clinical fields and development of related precise parts industries are essential for the development of the industry; advanced nations such as US, Japan, Germany, etc., which possess comparatively positive conditions, mainly have developed medical industries.

According to statistical data from the Korean Medical Devices Industry Association in Table 4.3, the number of Korean medical device manufacturers grew by around 1,011 companies for 9 years from 2005 to 2013, the number of items increased by 4,738, and the number of medical device importers also grew by 852 companies from 1,157 to 2009 for the same period.

Table 4.3
Numbers of Korean Medical Device Manufacturers and Importers
(Unit: companies)

	2005	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Manufacturers	1,596	1,624	1,662	1,726	1,754	1,857	1,958	2,227	2,607
Products	5,862	6,392	6899	7,367	8,003	8,704	9,086	9,667	10,600
Importers	1,157	1,281	1,381	1,456	1,466	1,496	1,570	1,762	2,009

Source: www.kmida.or.kr

Table 4.4 also shows that domestic production grew by 11.7% on average by year from KRW 194.9 billion in 2006 to 422.4 billion in 2013; in comparing the export and import of medical devices, export grew by 18.8% annually from 78.1 billion to 258.1 billion, and import also increased by 8.4% from 171.9 billion to 298.8 billion for the same period. The scale of domestic market grew by 7.1% per year from 288.7 billion to 463.2 billion for the same period. The growth seems to be attributable to the steady development of new hi-tech medical equipment thanks to advanced technologies in many countries including Korea and continuous creation and rapid expansion of new markets.

Table 4.4
Current Status of the Domestic Medical Device Industry
(Unit: KRW hundred million)

	2006	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Production	1,949	2,217	2,525	2,764	2,964	3,366	3,877	4,224
Export	781	959	1,248	1,519	1,681	1,853	2,216	2,581
Import	1,719	2,001	2,341	2,399	2,620	2,794	2,931	2,988
Market scale	2,887	3,259	3,618	3,644	3,903	4,306	4,592	4,632

Korean Market Scale = Domestic Production – Export + Import
Source: www.kmida.or.kr

Distribution Structure of Company A

As shown in Figure 4.1 below, Company A manufactures and imports medical devices and sells its products to its local authorized agencies (B2B franchises) that supply the products to hospitals or sell to retailers, which in turn sell them to small hospitals. Depending on the situation, the manufacturer directly sells them to hospitals. There are other distribution methods, such as manufacturers selling their products to purchase agencies as a proxy of the hospital by contract, or specific hospitals buying medical devices from agencies of other companies that have no contract with manufacturers. In other words, the products of manufacturers have impact on the sales of agencies, and the sales of agencies have impact on the sales of manufacturers.

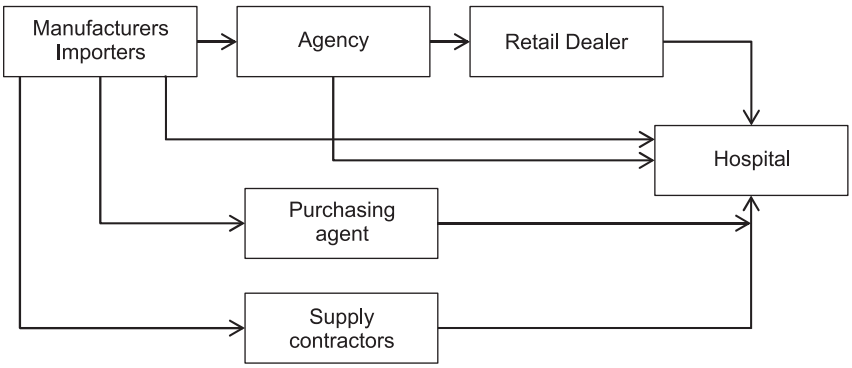

Figure 4.1: Distribution Structure of Company A

3. RESEARCH METHOD

Data

This research was based on sales data of medical device sales company A—1,463 medical devices and reagents sold to 284 agencies, suppliers, and hospitals for 47 months from January 2012 to November 2015.

Sales data is classified according to season for clustering analysis. Classification of seasonal sales is based on that spring is from March to May. Summer is from June to August. Fall is from September to November, and Winter is from December to February. It was calculated in accordance with the respective seasonal distributor sales.

Table 4.5 is descriptive statistics of variables. Average sales of spring are 132, 031,870 KRW that are higher than others, the other hand, fall is lower than others. Standard deviation of winter is 350,020,258 KRW that are higher than others.

Table 4.5
Descriptive Statistics of Research data
(Unit: Thousand KRW)

	Spring	*Summer*	*Fall*	*Winter*
Average	132,032	107,095	72,360	129,665
Median	3,089	2,399	911	2,881
SD	343,406	266,738	182,788	350,020
Range	2,560,768	2,054,197	1,447,568	2,454,521
Max	2,560,327	2,052,389	1,443,283	2,449,521
Sum	37,497,051	30,415,093	20,550,186	36,824,904
N	284	284	284	284

Research Process

Using SPSS (Statistical Package for the Social Sciences) as a statistical program and non-hierarchical clustering analysis for the accumulated seasonal sales data of company A, distances among the most outstanding sales agency group, outstanding sales agency group, average sales agency group, low sales agency group, and other agency group were calculated to check how similar their values are, and targets closest to each other were classified into the same group and sub-classified again. Moreover, in order to suggest a method of inducing higher sales by the average sales agency group and the low sales agency group through an analysis of sales of classified agencies and sales data of outstanding groups, 1,463 medical devices and reagents were classified into 61 product groups; the features of each agency group selling products to 284 retailers, suppliers, and hospitals were analyzed.

4. RESEARCH RESULTS

Cluster Analysis

K-means clustering was used for the cluster analysis on the agencies. The number of cases for clustering ranged from 2 to 5. Depending on the cluster analysis case, each clustering showed different average sales amounts and features. Specifically, clustering analysis was done by dividing the clustering cases into 2 and 3, but the agencies were too extensively clustered, and the clustering could not reflect the actual conditions of the company. Furthermore, when the clustering was analyzed by dividing into 4 and 5 cases, clustering case 4and clustering case 5were 251 and 255 clustering cases each; since they were sub-classified from the above, and clustering cases beyond 6 does not reflect the features of the company properly, additional clustering was not performed. After the analysis, adoption of clustering analysis with 4 cases (sales features of the agencies, Seoul and adjacent area, local provinces, and small and medium-sized agencies, and case reflecting sales tendencies of agencies well) seemed to reflect the form of the agencies of the company properly, and clustering with 4 cases was chosen as the target for this research as in Table 5.

Table 4.6
Clustering Analysis Summary
(Unit : Million KRW)

	N	*Average*	*Sum*	*Rate*
Cluster1	11	4,159	45,753	36.5%
Cluster2	20	1,837	36,743	29.3%
Cluster3	251	108	27,074	21.6%
Cluster4	2	7,859	15,717	12.5%
Total	284	441	125,287	100.0%

As a result of the clustering analysis, the agencies were classified into 4 clusters as in Table 4.6; cluster 1 showed the highest central value with average sales of KRW 4,159 million, followed by cluster 2 with 1,837million, cluster 3 with 108million, and cluster 4 with 7,859 million. The number in each cluster was not even: cluster 1 has 22 agencies, cluster 2, 20 agencies, cluster 3, 251 agencies, and cluster 4, 2 places including agencies, suppliers, and hospitals. Clusters 1, 2, and 4 are agencies under exclusive contract with company A, accounting for 78.4% of the total sales; the other agencies are complex agencies that do not sell all products of the company; they are under contract with 1 to 3 companies along with company A, and the proportion of products of company A is not high.

Table 4.6
Results of ANOVA

	Cluster		*Error*		*F*	*Significance probability*
	Mean Square (Unit : trillion)	*d.f*	*Mean Square (Unit : trillion)*	*d.f*		
Spring	10,318,785	3	8,633	280	1195.275	.000
Summer	5,991,034	3	7,722	280	775.832	.000
Fall	2,600,091	3	5,911	280	439.864	.000
Winter	10,336,221	3	13,082	280	790.134	.000

Table 4.6 shows ANOVA results. Difference of 4 clusters are identified to 4 season by ANOVA significant $<\alpha=.05$. So, clusters are identified to seasonal sales that clusters' attributes are seized to.

Table 4.7
Characteristics of Clusters for Season
(Average & Standard Deviation Unit : Million KRW)

No. of Cluster		*Spring*	*Summer*	*Fall*	*Winter*
1	Average	1,315	957	615	1,271
	N	11	11	11	11
	SD	177	240	161	315
2	Average	505	502	292	539
	N	20	20	20	20
	SD	214	194	176	316
3	Average	32	25	21	29
	N	251	251	251	251
	SD	69	51	55	55

	No. of Cluster	*Spring*	*Summer*	*Fall*	*Winter*
4	Average	2,400	1,725	1,286	2,448
	N	2	2	2	2
	SD	226	463	223	2
Total	Average	132	107	72	130
	N	284	284	284	284
	SD	343	267	183	350

Table 4.7 shows characteristic of clusters for season. Results of analysis of cluster divide by 4 clusters. Cluster 1has 11 agencies, cluster 2, 20 agencies, cluster 3, 251 agencies and cluster 4 are 2 agencies. The highest of seasonal sales is 132 million KRW from March to May. Followed by sales of winter is 130 million KRW from December to February. A sale of summer is 107 million KRW from June to august. Final, sales of fall is the lowest sales of seasons to 72 million KRW.

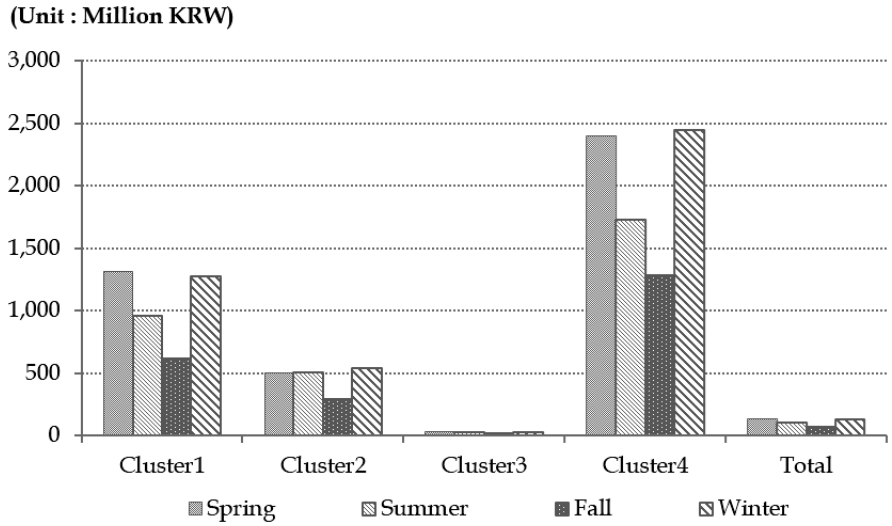

Figure 4.2: Average Sales per Agency

Figure 4.2 shows seasonal sales by clusters. The highest average sales per agency is cluster 4 followed by, cluster 1, 2 and 3. The highest total average seasonal sales are in order to spring, winter, summer and fall. Seasonal average sales of Cluster 1 and 3 are same to total average seasonal sales. And the lowest average seasonal sale shows fall of all clusters. On the other hand, seasonal average sales of cluster 2 and 4 is the highest winter sales.

Each Cluster's Channel Typology and Each Type's Sales Promotion Measures

According to the result of cluster analysis, it was found out that the cluster of distributors was divided according to sales by season. In addition, by analyzing the sales by product sold by each agency, a more specific sales strategy can be established.

Through the clustering analysis above, sales of the agencies were classified by 4 clusters as shown in Table 4.7. below. The agency sales classification showed that cluster 1, cluster 2, cluster3, and cluster 4 have different characteristics. Agencies of cluster 1 account for 36.5% of the total sales, agencies of cluster 2, 29.3%, agencies of cluster 3, 21.6%, and agencies of cluster 4, 12.5%.

The Table 4.8 shows that Cluster 1 agencies sell the products to comparatively small hospitals and deal with specific products of company A; the perception of hospitals to which the agencies sell products was comparatively low, and the low number of sales personnel of agencies and their low expertise can be said to have caused the comparatively fairly low sales of 255 agencies with KRW 33.1billion for 4 years. Agencies of cluster 1 are mostly small, trading products of rival companies. To activate sales of the products, small agencies should be merged into bigger ones and should be nurtured into specialized agencies of company A, so that they get more interested in the products of the company and sell them more enthusiastically. At the same time, through flexible pricing policies and sales promotion support and education and training for employees of agencies for exclusive sales of the products, similar products should be sold as cluster 4 and cluster 1.

Agencies of cluster 3 and cluster 4 have products with higher sales than products of cluster 1, but their sales of test products most frequently used at hospitals are comparatively low. For instance, the number of hospitals to which cluster 1 agencies sell CORE – CASSETTE (drug abuse tester), flu tester, hepatitis tester, and HIV (AIDS) testers and the number of hospitals clusters 4 and 1 sell to were not significantly different but comparatively lower. In comparing the sales of A1C (hemoglobin test) products, cluster 1 agencies have fairly lower sales than cluster 4 agencies. Since promotion of the products has not been done properly, employees of the agencies do not focus on selling them, and recognition of the hospitals about the products of company A is not comparatively high, hospitals of cluster 4 and 1 agencies were using products of rival companies. This seems to be attributable to the lower focus of the agencies on sales of the products. To address the issue, the company can hold product presentations so that the agencies can promote the products to hospitals or install booths at local medical seminars to raise brand image and perception of the products, inform hospitals of the excellence of the products, and suggest competitive prices to outperform its rivals; such is expected to activate sales.

Agencies of cluster 4 deal with many products of the company but do not sell some of the products that the other agencies sell a lot. For instance, they have not sold products used at hospitals very frequently such asA1C (Hemoglobin Test) products, BNP (early diagnosis and check of congestive heart failure) products, cardio renal (heart-kidney syndrome test) products, other tubes (such as blood collection tubes, etc.) for the last 4 years. This seems to be mainly attributable to the fact that the agencies of cluster 4are not interested in products and that they find it hard to sell them to hospitals, employees' low perception about the product and insufficient marketing activities with poor expertise, etc. To deal with such issues of the agencies, the company can provide knowledge about products for the employees of the agencies and expertise education and training for doctors, hold open product presentations by visiting hospitals together with the employees, provide support to improve the brand image of the company, and temporarily adjust the prices of its products so that they can hold their own against their rivals until their sales get to the normal level.

Through the cluster analysis, agencies of the company were classified, common features in sales of the agencies and their strong and weak features were identified, and proper sales promotion methods of the company for its agencies were searched. Through the resolution of the issues, the company can find ways to promote its sales.

Table 4.8
Summary of Classification Analysis of Each Cluster Agency

Classification	*Cluster 1 (n = 11)*	*Cluster 2 (n = 20)*	*Cluster 3 (n = 251)*	*Cluster 4 (n = 2)*
Sales KRW	45,753 million	36,743 million	27,074 million	15,717 million
Features	Sales of Generally Diverse Products, but Lower Sales of Core-Cassette (Drug Abuse Test) Products, Flu Test Products, Hepatitis Test Products, HIV (AIDS) Test Products than Cluster 4 Compared to Hospitals that Agencies are Dealing with	Selling Similar Products as Cluster 1, but Significant Difference in Sales Amount, Especially Lower in Sales of A1C (Hemoglobin Test) Products	Management of Hospitals as Small Agencies and Trading of Specific Products, Low Exposure of Company A's Products at Hospitals, Low Expertise of Agency Sales Personnel in the Products, and Dealing with Products of Rival Companies	Strong in Sales of Flu Test Products, Hepatitis Test Products, HIV (AIDS) Test Products but Weak in Sales of A1C (Hemoglobin Test) Products, BNP (Congestive Heart Failure Early Diagnosis) Products, Cardiorenal (Heart-Kidney Syndrome Test) Products, other tubes (as blood collection tubes)
Marketing Promotion Methods	Product Promotion through Holding of Presentations and Higher Brand Image Recognition through Installation of Booths at Local Medical Societies or Seminars and Implementation of Competitive Pricing Policies	Product Promotion through Holding of Presentations and Higher Brand Image Recognition through Installation of Booths at Local Medical Societies or Seminars and Implementation of Competitive Pricing Policies	Nurturing into Specialized Agencies by Merging Small Local Agencies and Pricing Policies and Sales Promotion Support	Through Agency Employees' Expertise Education and Training and Holding of Product Presentation, Improvement of Brand Image; Temporary Price Reduction

5. CONCLUSION

The purpose of this research is to search methods to improve sales of B2B small and medium companies whose utilization of information system is insufficient based on their limited data resources. To this end, the agencies of a Korea-based foreign company were clustered using monthly sales data by agency, and products and strategies for each cluster were established for higher sales. The analysis was done using SPSS 18.0, and the analysis results can be summarized as follows:

As a result of the clustering analysis of agencies using K-means clustering, the agencies were classified into 4 clusters. Cluster 4 showed the highest central value with KRW 7,859 million in sales on average, followed by cluster 1 with KRW 4,159 million, cluster 2 with KRW 1,837 million, and cluster 3 with KRW 108 million. Cluster 1 has 11 agencies, cluster 2, 20 agencies, cluster 3, 251 agencies, and cluster 4, 2 agencies; the distribution of agencies of each cluster was not consistent because clusters 1, 2, and 3 are agencies under exclusive contract with company A, and their sales of specific products are high; the rest of the agencies are complex-type agencies that sell products of 1~3 companies, and their sales of company A's products are not so high. Through such clustering analysis, agencies of company A were classified, common features in the sales of the agencies were investigated, strong points and weak points of agencies were identified, proper sales promotion methods that the company can provide for the agencies were suggested, and higher sales of the company through the solutions could be searched.

This research suggests a new method with which small and medium B2B companies as manufacturers can support their authorized agencies—their key sales channels—for the growth of sales by classifying the agencies and analyzing their sales features through clustering analysis on the accumulated sales data of the agencies.

As a limitation of this research, the sales data of only one medical device sales company were analyzed, and research on more B2B companies is required; if clustering analysis is applied after considering the environmental factors of diverse companies including structured data other than sales data, provision of more realistically effective information and sales promotion methods for the agencies can be expected.

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