Application of Network Analysis for FMCG Distribution Channels

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Abstract The paper presents the approach for multidimensional analysis of marketing tactics of the companies employing network tools. The research suggests omni-channel distribution tactic of a company as a node in eight-dimensional space. Dimensions for node location are defined by frequency of usage of eight communication channels (friends, acquaintances, telephone, home presentations, printed advertisement, internet, e-mail, and door to door). The comparison is grounded on measuring pairwise distance between nodes in eight-dimensional space. Pairwise distance measured by Euclidean norm is used as a weight of edge between companies. The smaller the Euclidean distance, the higher is similarity. Further, we employ network representation of multidimensional statistics to analyze performance and companies' characteristic, such as product category, market share, education level, and average age of distributors. Empirical implication is approved on the sample from 5694 distributors from 16 fast moving consumer goods (FMCG) distributing companies from direct selling industry.

1 Introduction

In direct selling traditionally communication with customers is the key aspect for distribution channel successes. Communication is based on demonstrations and personal engagement that make the buying process highly tangible and multisensory for consumers [7]. The close involvement with the product and personal communication has been a key differentiating feature of direct selling when compared to

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other methods of sales and communication with potential customers [11]. Usage of internet technologies for communication may improve productivity, but challenge the customary "high-touch" tradition in the industry [4].

Previously, studies have mainly considered separately offline and online channels [5, 6]. In our research, we estimate usage of all channels simultaneously employing omni-channel concept. Omni-channel retailing reflects the fact that salesperson interacts with customers through numerous channels. Integration allows taking advantages of digital channels (wide selection, rich information, and reviews) and advantages of physical stores (personal service, the ability to touch products, convenient returns, and shopping experience) [12]. In omni-channel concept, different channels become blurred as the natural borders between channels begin to disappear [15]. Our research is designed to compare multidimensional tactics as a combination of different communication channels for distribution. Each combination of channels is considered an omni-channel tactic of a company (friends, acquaintances, telephone, home presentations, printed advertisement, internet, e-mail, and door to door). The purpose of this study is to investigate the distribution tactics of different small-, medium-, and big-sized FMCG companies in DS industry in relation to performance.

2 Direct Selling Distribution Channel

The paper is illustrated with data from direct selling (DS) industry. Direct Selling Associations define DS as a method of marketing and retailing goods and services directly to the consumers, in any location away from permanent retail premises. The company provides partners with the opportunity to build own business with full- or part-time employment and getting profit from it. For consumers, it is an alternative to stationary shops and allows to make purchases in a convenient location with a personal approach.

According to World Federation Direct Selling Association (WFDSA) report, worldwide sales at direct selling companies were 182.8 billion US dollars in 2014, with a sales force estimated at 99,7 million independent contractors worldwide [16]. Sales in the Europe countries in 2014 were reported to be 32,6 billion and the number of sales people was 13,97 million.

Russian Federation is the world's 11th largest direct selling market. In 2014, direct retail sales were in excess of 3.6 billion US dollars, showing a 3-year compound annual growth rate of 1.6% (2011–2014). Number of independent direct sellers showed a 7.6% increase to 5.4 million in 2014 (5 425 830).

On emerging markets, direct selling industry fills the gap in weak distribution system, especially in regions. For citizens, direct selling is the source for additional income. Distributors are considered as individual small enterprises [1].

In the paper, we employ the term distributor based on the functions implemented. DS distributor is an independent contractor who performs functions of retailers—promote, sell, and distribute products and services to consumers [11]. An integral aspect of the DS industry is a personal presentation in a face-to-face manner [13].

Products are demonstrated to an individual, or to a group or where a catalogue is left with the consumer and where the direct seller calls later to collect orders.

3 Sample Description

Data for the research was collected jointly with the Russian Direct Selling Association (RDSA), (www.rdsa.ru) member of World Federation Direct Selling Association in spring 2014. The questionnaires were spread among companies with RDSA membership, the sample was quoted according to the number of the distributors. The sampling frame included 5694 independent sellers from 16 biggest direct selling companies in Russia. The companies are focused on distribution of FMCG: personal care products, nutrition, perfumes, cosmetics, hygiene products, jewelry, and accessories. Table 1 summarizes the descriptive statistics of the sample.

In the research, we consider only single-level direct selling companies, where salespeople devote all efforts to selling and achieve all compensation based on their own sales and do not build an organization via recruiting and training [2]. The sampling frame includes sellers from 16 DS companies: Amway, AVON, Faberlic, Florange, Herbalife, LR Health & Beauty Systems, Mary Kay, Tapperware, Mirra, Nu Skin, Oriflame, Nikken, Jafra, CIEL, Tentorium, Morinda. The companies are focused on distribution of products for personal care, nutrition, beauty, and household: perfumes, cosmetics, hygiene products, jewelry, and accessories.

4 Channels and Tactics

Companies use variety of channels for communication with customers and distribution. In the research, we analyze eight communication channels used by direct sellers. Table 2 presents statistics of channel usage frequency. Sales via personal communication with friends and acquaintance are on the top lines.

According to the definition of Cambridge dictionary, friends are people who are known well and liked a lot. Usually it is a small number of people from close surrounding. Acquaintance is defined as a person that you have met but do not know well. It might be classmates, colleagues, and different group's mates.

Different channels within each tactic can be used by distributors with different frequency. Frequency is relative to the time salesperson spends for selling activities, which varies from 1 hour up to 40 hours per week. Frequency is measured by four-point scale from "never use=1", "rarely=2", "occasionally=3", and "frequently=4". The *Cronbach alpha* value of the scale is equal to "0.77", indicating satisfactory internal reliability. Figure 1 shows frequency of different channels usage for different age groups within the total sample.

Totally there are 256 different combinations from eight individual channels. Each combination is considered as an omni-channel tactic of salesperson. We use

Table 1 Sample descriptive statistics

		Number of salespersons	Percentage (%)
Age groups	<18	28	0.5
	19–24	492	8.7
	25–30	775	13.6
	31–34	502	8.8
	35–40	684	12.0
	41–50	1159	20.4
	51–55	789	13.9
	56–65	973	17.1
	>65	278	4.9
Work experience	Less than one year	1251	22.2
	1 year	543	9.6
	2 years	599	10.6
	3 years	503	8.9
	4 years	373	6.6
	5 years	430	7.6
	6 years	335	5.9
	7–10 years	791	14.0
	More than 10 years	808	14.3
Location size	Over 1 mln. people	2579	46.2
	500 thousand–1 mln. people	957	17.2
	100 thousand–500 thousand people	1017	18.2
	10 thousand–100 thousand people	693	12.4
	Less than 10 thousand people	332	6.0
Hours spent for work, per week	<1	672	12.0
	1–4	1704	30.5
	5–9	1076	19.2
	10–14	656	11.7
	15–19	414	7.4
	20–29	468	8.4
	30–40	301	5.4
	>40	304	5.4

(continued)

Table 1 (continued)

		Number of salespersons	Percentage (%)
Income per month, rub.	<3,000	2002	36.1
	3,000–4,999	825	14.9
	5,000–9,999	731	13.2
	10,000–14,999	540	9.7
	15,000–24,999	492	8.9
	25,000–34,999	276	5.0
	35,000–49,999	241	4.3
	>50,000	434	7.8
Total		5,694	100

Table 2 Breakdown by channel usage (Percentage, amount of salespersons)

Communication channels	Do not use (%)	Rarely (%)	Occasionally (%)	Frequently (%)
Friends	18	7.3	20.7	55.3
Acquaintance	18	7.9	24.3	50.7
Telephone	42	10.3	15.1	33.0
Home presentations	44	16.4	20.5	20.2
Printed advertisement	47	14.5	20.7	18.7
Internet	54	13.0	15.3	18.7
E-mail	66	12.2	11.9	9.9
Door to door	85	9.8	3.4	1.8

two-mode graph to analyze structure and relationships of tactics within the industry. To better understand the structure and effectiveness of the company's distribution network [8, 10], we examine the effects of the network structure on the performance.

Figure 2 depicts the overall two-mode network for 256 tactics used by 5694 independent sellers. It is seen that some tactics are more popular than other within distributors; 66 tactics are not used at all. Out of 190 tactics, only 130 are used by more than one salesperson. Unfortunately, the total picture is not rather clear due to the large amount of distributors and tactics. Therefore, we agglomerate the object of the research. Further, we are focusing on the company's tactic level.

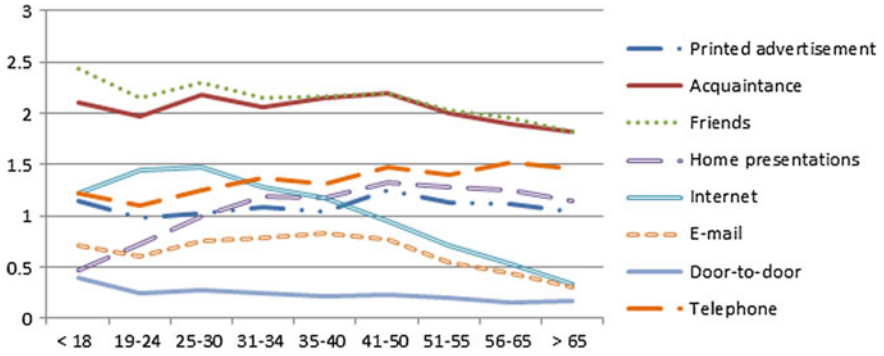

Fig. 1 Distribution channels used by different age groups

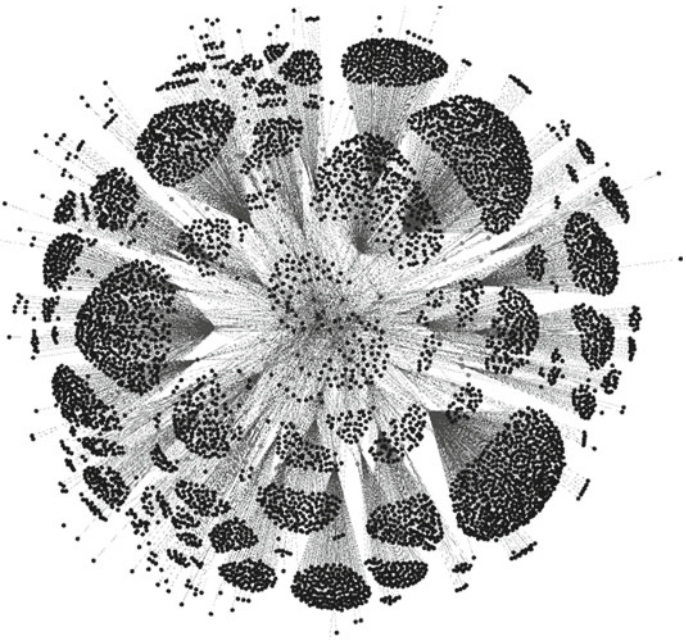

Fig. 2 Two-mode network of the sample (distribution tactics and distributors)

5 Comparison of Communication Tactics in Distribution Channels

Distribution tactic of the company is a set of communication channels, which are used with different frequency. Table 3 presents frequency of different channels usage for each company. All companies employ existing channels, but with different frequencies. In our sample, number of respondents for each company in average is

Table 3 Frequency of distribution channel usage

Channels Company	Friends	Acquaintances	Tele phone	Home presen-tations	Printed adver-tise-ment	Internet	E-mail	Door to door
A	0.30	1.90	2.18	1.85	0.52	0.30	0.13	1.30
B	1.23	2.12	1.97	0.70	0.83	0.55	0.18	1.18
C	0.77	2.07	2.13	1.12	1.52	0.87	0.19	1.57
D	1.44	2.57	2.57	1.89	1.80	1.42	0.14	2.08
E	1.67	2.22	2.25	2.06	0.51	0.42	0.14	1.77
F	1.06	1.87	1.80	0.68	0.46	0.27	0.05	0.88
G	0.97	2.12	2.04	1.11	0.88	0.85	0.17	1.71
H	1.22	1.99	2.16	0.62	1.39	0.73	0.29	0.95
I	1.34	1.99	1.95	1.03	1.05	0.44	0.62	1.35
J	0.87	1.89	1.98	0.99	0.50	0.48	0.11	1.66
K	1.12	2.18	2.19	1.77	0.79	0.75	0.31	1.84
L	2.26	2.44	2.40	1.08	1.58	0.79	0.16	1.24
M	1.20	2.29	2.15	1.09	1.02	0.62	0.17	1.41
N	0.88	1.66	1.70	0.54	0.66	0.54	0.15	0.96
O	1.27	1.83	1.89	0.72	0.72	0.61	0.17	1.14
P	1.04	1.89	2.06	0.55	1.06	0.58	0.38	0.84

equal to 350. Frequency of channel usage for each company was calculated as mean observation.

To estimate similarity of the tactics we use Euclidean norm concept [9, 14]. We estimate how far points between each other in eight-dimensional space are. Node location for each company is described by a node in eight-dimensional space. For example, point position for Amway company is derived from frequency of each channel usage and coded as (0.30; 1.90; 2.18; 1.85; 0.52; 0.30; 0.13; 1.30). We calculate pairwise distance between nodes employing Euclidean norm.

On a n-dimensional Euclidean space *Rn*, the intuitive notion of length of the vector $x = (x_1, x_2, ..., x_n)$ is captured by the formula

$$\|\overrightarrow{X}\| = \sqrt{x_1^2 + \cdots + x_n^2}, \tag{1}$$

where $x_i$location of node identified by usage of distribution channel i.

We employ equation for eight-dimensional Euclidean space, as company's tactic is described by eight parameters.

$$\begin{aligned}\|\overrightarrow{X_p}\|_2 &= \sqrt{\|X_1 - X_2\|_2} \\ &= \sqrt{(x_{11} - x_{21})^2 + (x_{12} - x_{22})^2 + \cdots + (x_{18} - x_{28})^2},\end{aligned} \tag{2}$$

Table 4 Pairwise distance (Euclidean norm)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
A	0	1,56	1,48	2,32	1,5	1,51	1,29	1,86	1,53	1,12	1,16	2,48	1,38	1,58	1,57	1,69
B	1,5	0	1,07	2,12	1,61	0,67	0,78	0,69	0,65	0,78	1,3	1,45	0,55	0,71	0,34	0,57
C	1,4	1,07	0	1,46	1,73	1,55	0,69	0,94	1	1,14	1,09	1,6	0,76	1,38	1,19	1,13
D	2,3	2,12	1,46	0	1,75	2,69	1,62	2,03	1,93	2,17	1,4	1,59	1,62	2,65	2,27	2,34
E	1,5	1,61	1,73	1,75	0	1,85	1,33	1,97	1,42	1,41	0,78	1,71	1,26	2,05	1,65	2,01
F	1,5	0,67	1,55	2,69	1,85	0	1,24	1,15	1,08	0,9	1,66	1,98	1,1	0,48	0,56	0,81
G	1,2	0,78	0,69	1,62	1,33	1,24	0	1,09	0,83	0,61	0,73	1,61	0,5	1,16	0,87	1,12
H	1,8	0,69	0,94	2,03	1,97	1,15	1,09	0	0,83	1,3	1,58	1,3	0,83	1,01	0,79	0,45
I	1,5	0,65	1	1,93	1,42	1,08	0,83	0,83	0	0,95	1,09	1,37	0,63	1,07	0,72	0,82
J	1,1	0,78	1,14	2,17	1,41	0,9	0,61	1,3	0,95	0	1,02	1,97	0,82	0,91	0,76	1,13
K	1,1	1,3	1,09	1,4	0,78	1,66	0,73	1,58	1,09	1,02	0	1,7	0,86	1,7	1,37	1,63
L	2,4	1,45	1,6	1,59	1,71	1,98	1,61	1,3	1,37	1,97	1,7	0	1,25	2,06	1,59	1,64
M	1,3	0,55	0,76	1,62	1,26	1,1	0,5	0,83	0,63	0,82	0,86	1,25	0	1,15	0,77	0,92
N	1,5	0,71	1,38	2,65	2,05	0,48	1,16	1,01	1,07	0,91	1,7	2,06	1,15	0	0,53	0,66
O	1,5	0,34	1,19	2,27	1,65	0,56	0,87	0,79	0,72	0,76	1,37	1,59	0,77	0,53	0	0,6
P	1,6	0,57	1,13	2,34	2,01	0,81	1,12	0,45	0,82	1,13	1,63	1,64	0,92	0,66	0,6	0
Total distance	24,03	14,84	18,22	29,96	24,02	19,24	15,48	17,83	15,93	17,00	19,07	25,31	14,41	19,11	15,56	17,54

where $\mathbf{x}_{11}$ is the average meaning for channel 1 of company 1 and $\mathbf{x}_{21}$ average meaning for channel 1 of company 2.

We have introduced parameter "total distance", which is equal to the sum of all distances of the company with other companies. Parameter "total distance" reflects uniqueness of the companies' tactics. Also, it is used for comparison of the companies and further analysis.

We use results from the Table 4 for network analysis. We draw the network, where nodes are companies. Nodes are connected if companies use the same channels in their tactics. On the company level, all companies use all channels, therefore we have complete graph. Weight of the edge on the graph is measured by pairwise distance. Smaller distance designates closer connection between companies.

The evaluation determined by the Euclidean norm makes us understand the similarity by using an expression based on the concept of norm. The smaller the Euclidean, the higher is similarity. Similarity of the tactics is based on the simultaneous evaluation of usage frequency of all eight communication channels. Further, we employ network visualization tools to analyze performance and companies' characteristic, such as product category, market share, education level, and average age of distributors.

Table 5 Direct selling by category: % Value Growth 2009–2014

% current value growth, retail value excl. sales tax	2013/14	2009-14 CAGR	2009/14
Apparel and footwear	3.9	38.0	401.2
Beauty and personal care	−3.2	−0.8	−3.9
Consumer healthcare	15.5	27.1	231.7
Consumer appliances	8.9	13.7	90.1
Home care	6.3	8.7	51.7
Home improvement and gardening	25.7	10.1	62.0
Housewares and home furnishings	−1.7	−3.9	−18.1
Direct selling	1.5	4.9	27.3

Source Euromonitor International from official statistics, trade associations, trade press, company research, trade interviews, trade sources

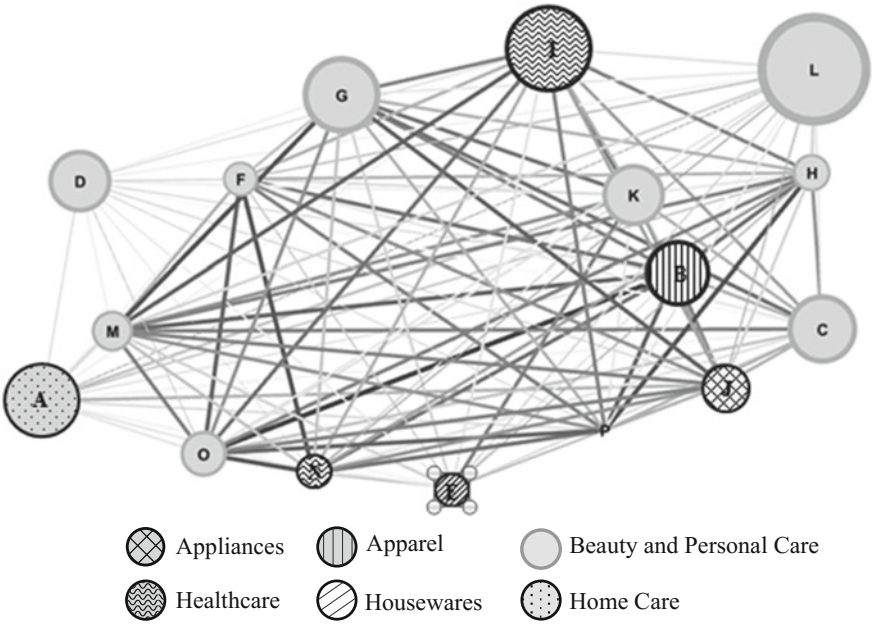

Fig. 3 Distribution tactics and efficiency

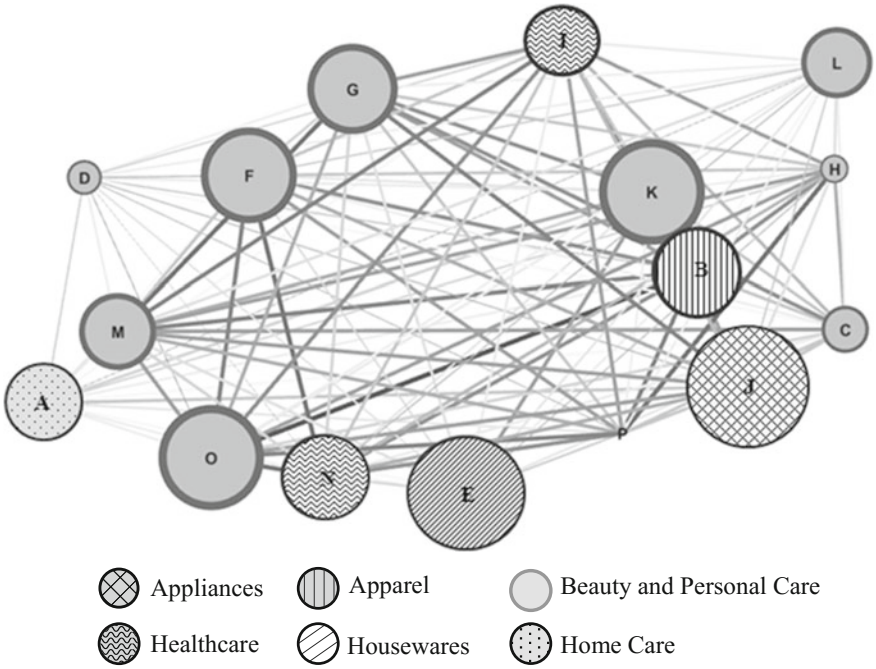

Fig. 4 Age and distribution tactics similarity

6 Companies' Characteristics, Tactic, and Performance

Performance is measured by self-report on net profit per hour (income) from selling activities. Self-reported performance has been shown to be reliable in previous sales force research [3].

The investigated companies are devoted to different product categories. Each category may strongly identify distributor's characteristics and their communication strategies with customers. Euromonitor International identifies seven categories within direct selling industry. The statistics of these categories is shown in the Table 5. In our research, we use six product categories excluding "Home Improvement and Gardening".

Figure 3 visualizes closeness of communication tactics of companies. The graph (Fig. 3) is edge-weighted. Weight of the edge is measured by Euclidean norm which assigns to each vector the length of its arrow. Thickness of the arrows between companies shows similarity. Thicker tie means more similar tactics between pair of the companies.

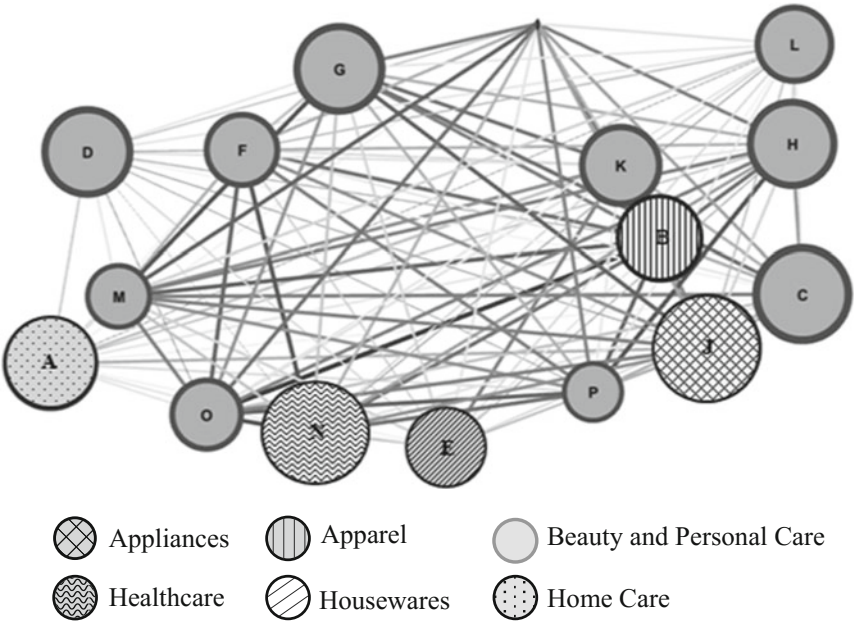

Fig. 5 Education level and distribution tactics similarity

Nodes would have different attributes. In Fig. 3, size of the nodes reflects display performance. Coloring of the node shows product category (Table 5).

As it is seen from the Fig. 3 the highest productivity has got company L from "beauty and personal care" product category. At the same time, this company has got weak tights with other companies therefore it has got unique tactic (total distance = 24.31). Group of companies from "beauty and personal care" product category with low performance from F, H, M,O have got total distance lower than 20.

Comparing communication tactics of companies from "beauty and personal care" product category (Table 3), we see that company L has got the highest frequency of using channel "Friends". Tactic of the company A from "home care" product category is also outstanding (with total distance=24.03).

We may suggest that unique tactic provides better performance. We calculated Pearson correlation coefficient between total distance and performance. For 10 companies from "beauty and personal care" industry, correlation coefficient is equal to 0.47. According to Chaddock scale the correlation is positive but weak.

Age. In Fig. 4, size of nodes reflects an average age of the distributors within the company. The bigger diameter the higher is the age. Characteristic of age has no much influence on the companies' tactic. Companies E and J with the highest age have no similarities in tactics.

Table 6 Direct selling company (Brand) shares: % Value 2010–2014

% retail value rsp excl sales tax	2010	2011	2012	2013	2014
Avon Products ZAO	27.2	24.7	23.0	23.0	21.8
Amway OOO	17.0	17.5	19.2	19.4	19.3
Oriflame Cosmetics ZAO	22.4	20.5	17.6	16.5	15.6
Mary Kay ZAO	8.8	8.6	8.8	10.0	10.5
Faberlic OAO	3.5	5.2	5.9	6.1	6.1
Herbalife International RS OOO	1.5	2.3	3.1	3.9	4.7
Tupperware OOO	3.0	2.3	2.2	1.9	1.7
LR Rus OOO	–	–	0.7	1.3	1.6
Nikken OOO	0.6	0.6	0.6	0.5	0.4
Nu Skin Russia	0.4	0.3	0.4	0.4	0.4
Others	10.9	13.6	14.6	13.3	14.5
Total	100.0	100.0	100.0	100.0	100.0

Source Euromonitor International from official statistics, trade associations, trade press, company research, trade interviews, trade sources.

Education level. In Fig. 5, size of nodes reflects an average education level of the distributors within the company. It is seen that education level is almost equal for all companies and is equivalent to higher education. Company J which is selling appliances has got distributors with the higher level of education.

Market share. Companies within research sample have got different size and market share. Table 6 presents top 10 companies of the industry. All of them are presented in our research. Totally they amount 85% of direct selling market in Russia. As it is seen from the table, there is a strong difference in market share between companies.

Figure 6 help us to analyze if company's market share has got effect on tactic. Market leaders from "beauty and personal care" companies H and P have got similarities in tactics, but are different to A company tactics from "home care" product category. But at the same time, tactics of big companies are alike to small companies. So, there is no significant difference in tactics of small and big companies.

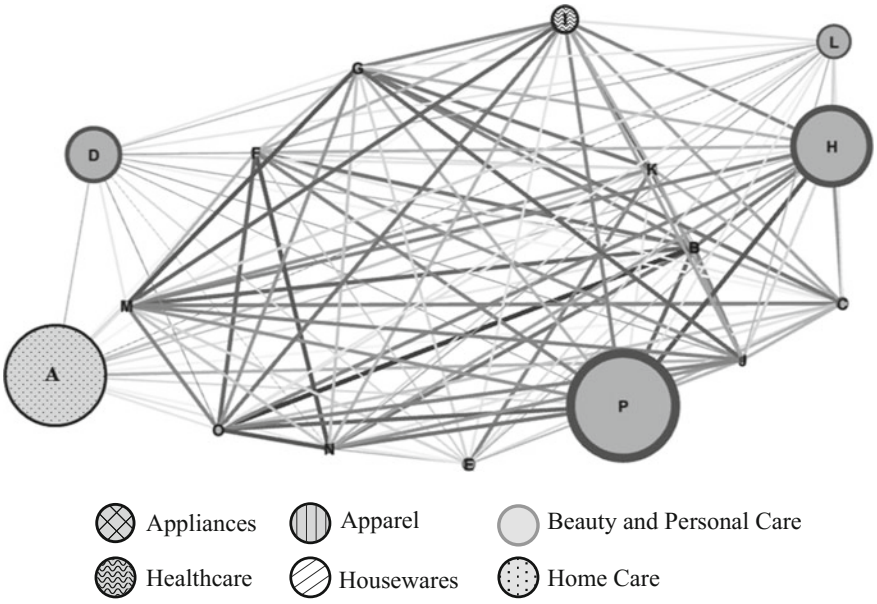

Fig. 6 Market share and distribution tactics similarity

7 Conclusions

Company success strongly depends on effective communication with customers of distributor's network. The above network representation of multidimensional statistics provides us with a deeper understanding of idiosyncrasies of distribution communication tactics between companies with different characteristics.

The main contribution of the paper is in application of network approach and Euclidean norm concept for multidimensional analysis of distribution tactics of FMCG companies. The study simultaneously estimates usage of eight communication channels applying omni-channel approach. Empirical application of the approach for analysis of distribution tactics of FMCG companies shows that it is useful for analysis of eight-dimensional tactics of numerous companies from six different product categories.

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