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Visualizing Asymmetric Competition among more than 1,000 Products using Big Search Data

INFORMS Science to Practice Initiative

Based on: Ringel DM, Skiera B (2016) Visualizing Asymmetric Competition among more than 1,000 Products using Big Search Data. Marketing Science 35(3):511-534

Firms must Understand the Competitive Environment they Operate in

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Determine **Status Quo**

as basis for

Identify **Drivers**

as basis for

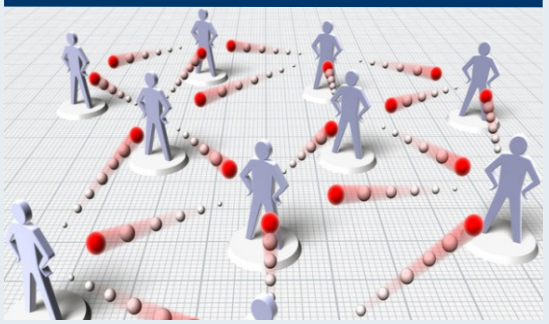
Take **Action**

Impact?

Market Shares

EASY: From Research Reports

Market Structure & Relations



DIFFICULT: Pirmary Data Collection
Complex Analysis

MANUFACTURERS

- Pricing and Positioning
- Communication
- New Product Development

RETAILERS

- Assortment and Purchasing
- Inventory Management
- Pricing
- Communication

Traditional Approach for Analyzing Competitive Market Structure: Perceptual Mapping

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A perceptual map is a visual representation of how consumers view competing alternatives in a Euclidean space which represents the market

1 Collect Data

Survey consumers on how similar (dissimilar) they perceive pairs of producs to be using a 7-point scale (1 very similar to 7 very different)

Example: 4 products (A,B,C,D)

Products	Very similar						Very different
A B	1	2	3	4	5	6	7
A C	1	2	3	4	5	6	7
.							
.							
C D	1	2	3	4	5	6	7

Ask each respondent:

N x (N-1) / 2 pair-wise questions

N=4: 4 x (4-1) / 2 = 6 questions

! ***Only feasible for markets with few products***

Traditional Approach for Analyzing Competitive Market Structure: Perceptual Mapping

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A perceptual map is a visual representation of how consumers view competing alternatives in a Euclidean space which represents the market

2 Visualize Competitive Market Structure

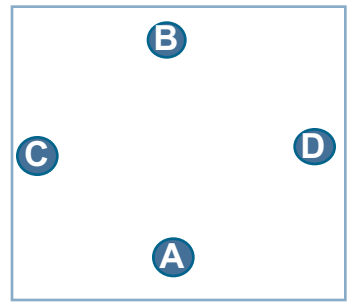
Use **Multidimensional Scaling (MDS)** to create a visual representation of competitive market structure based on consumers' perceptions

Calculate mean ratings for all product pairs and transfer into a joint table of product dissimilarity

	A	B	C	D
A				
B	4.2			
C	1.9	2.3		
D	2.3	2.7	4.9	

The greater the value of a cell, the less similar the two products are

Visualize using MDS (available in SPSS, STATA, SAS, R, etc.)



The greater the distance between two products, the less similar these two products are

MATLAB CODE for MDS
d=[0 4.2 1.9 2.3;4.2 0 2.3 2.7;...
1.9 2.3 0 4.9;2.3 2.7 4.9 0];
c={'A','B','C','D'};
[Y,stress,disparities] = mdscale(d,2);
distances = pdist(Y);
dx = 0.1; dy = 0.1;
scatter(Y(:,1),Y(:,2));
text(Y(:,1)+dx, Y(:,2)+dy, c);

! *As the number of products increases, MDS solution quality is known to deteriorate*

Today's Durable Markets are Large

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Market*	Brands	Products	HHI**	Largest Share	Mean Share	Brands in Top 50
Washing Machines	43	1,196	54	2.23%	0.08%	35%
Vacuum Cleaners	96	1,514	65	3.01%	0.07%	13%
Digital Cameras	48	920	98	3.98%	0.11%	21%
Lawnmowers	33	518	140	5.18%	0.19%	24%
Toasters	71	408	179	5.82%	0.25%	28%
Smartphones	32	658	403	14.64%	0.15%	31%
Espresso Machines	28	459	265	7.53%	0.22%	29%
Car Navigation Systems	52	670	333	8.43%	0.17%	7%

* Source: GfK Retail Panel Germany September 2012

** Herfindahl-Hirschman Index measures market concentration (1 to 10,000) HHI < 100 is highly competitive and <1,000 not concentrated

Big Data Problem

Traditional Approaches for Visualizing Competitive Market Structure

Relationship Matrices drawn to Scale

10 Products
DeSarbo & Grewal (2007)

62 Products
Kim et al. (2011)

169 Products
Netzer et al. (2012)

1,000 Products

- How to collect data on over 1,000 products?
- How to process and analyze these data?
- How to visualize competitive market structure among over 1,000 products?

New Idea: Leverage Online Search Data

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Every day, Millions of Consumers ***SEARCH & COMPARE*** *Products online*

What is searched a lot is bought a lot

Search frequency as proxy for

Market Share

Products searched together are substitutes

Substitutes are very similar: Similarity as proxy for

Competition

Consideration Sets as Arbiters for Competition

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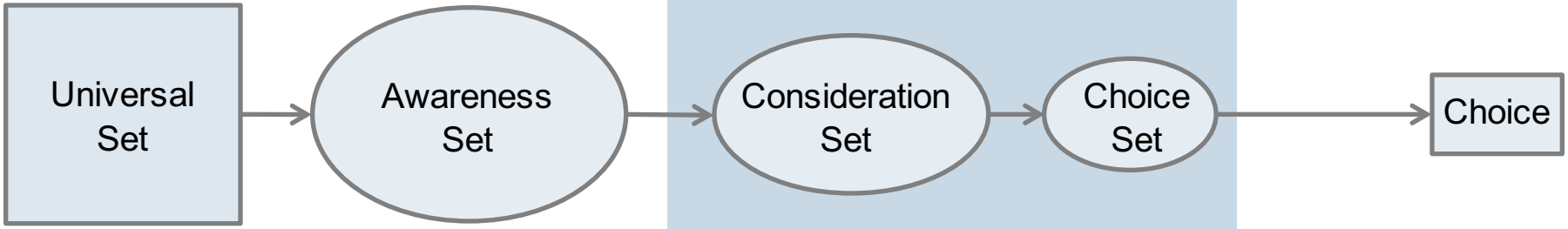
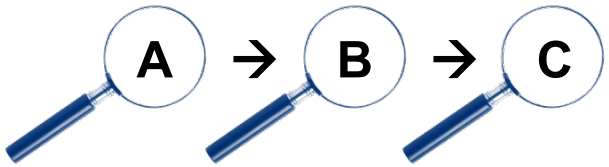
Hierarchical Choice Model

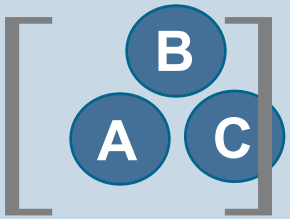
Shocker et al. (1991)



Online search for products



viable substitutes



= competitors

Competition can be Asymmetric

weak

Competition

arrows point at competitor

strong

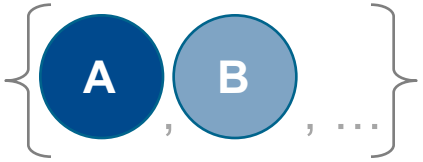
From iRiver's perspective, Apple is a very strong competitor

From Apple's perspective, iRiver is hardly a competitor at all

Competitive Asymmetry among two Products can be Identified from Consideration Sets

Given:

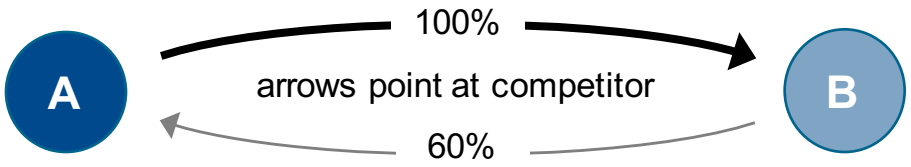
A is included in
3 consideration sets



A and B are jointly included
in 3 consideration sets

B is included in
5 consideration sets

Conditional probability: What is the probability that A is considered, given that B is considered?



A given B
B is always a competitor to A

B given A
A is only a competitor to B in 60% of B's consideration sets

B is a stronger competitor to A than vice versa

New Approach for Visualizing Competitive Market Structure among over 1,000 Products

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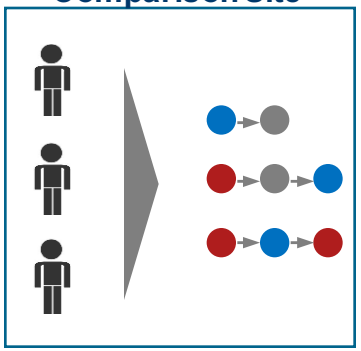
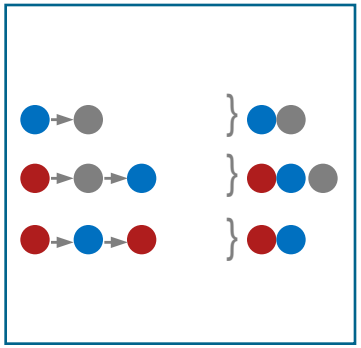
1 Data

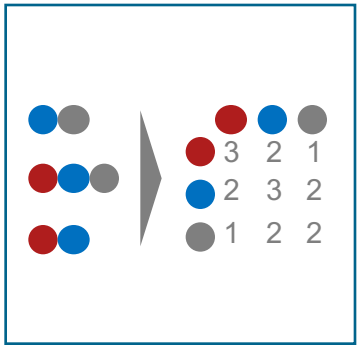
Collect Clickstreams from Price-Comparison Site



Construct Consideration Sets from Clickstreams

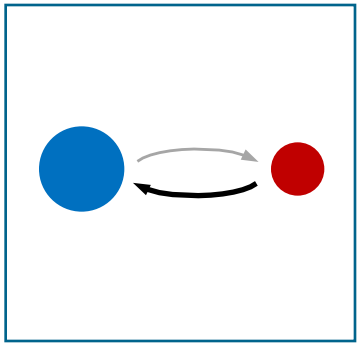


Build Matrix of Joint Consideration from Consideration Sets

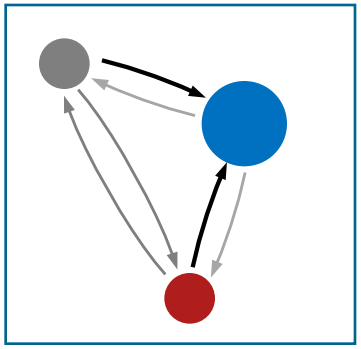


2 Analysis

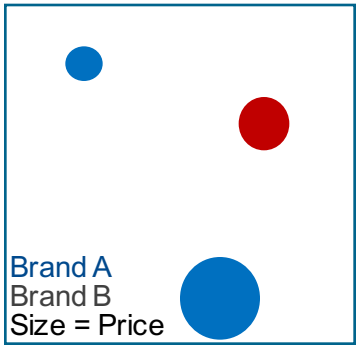
Identify Competitive Asymmetry from Consideration Sets



Visualize Competitive Market Structure with DRMABS*



Investigate Market Structure using Attributes



* ***DRMABS*** (**D**ecomposition and **R**e-assembly of **MA**rkets **B**y **S**egmentation) is a newly developed model to visualize asymmetric competitive market structure among hundreds of products in a single map whereby submarket structures are explicitly detected and visualized

Empirical Application

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LED TV Market

Data source:	Product & Price Comparison Site
Category:	LED TVs
Time:	September 2012
Country:	Germany
Observed consumers:	105,606
Brands:	56
Products (SKUs):	1,124
Possible competitive relations:	1,262,252

Objectives

1. **Analyze and visualize asymmetric competitive market structure**
2. **Validate Online Search Data**
3. **Compare new DRMABS mode to traditional mapping techniques**

Competitive Market Structure Map for 1,124 LED TVs

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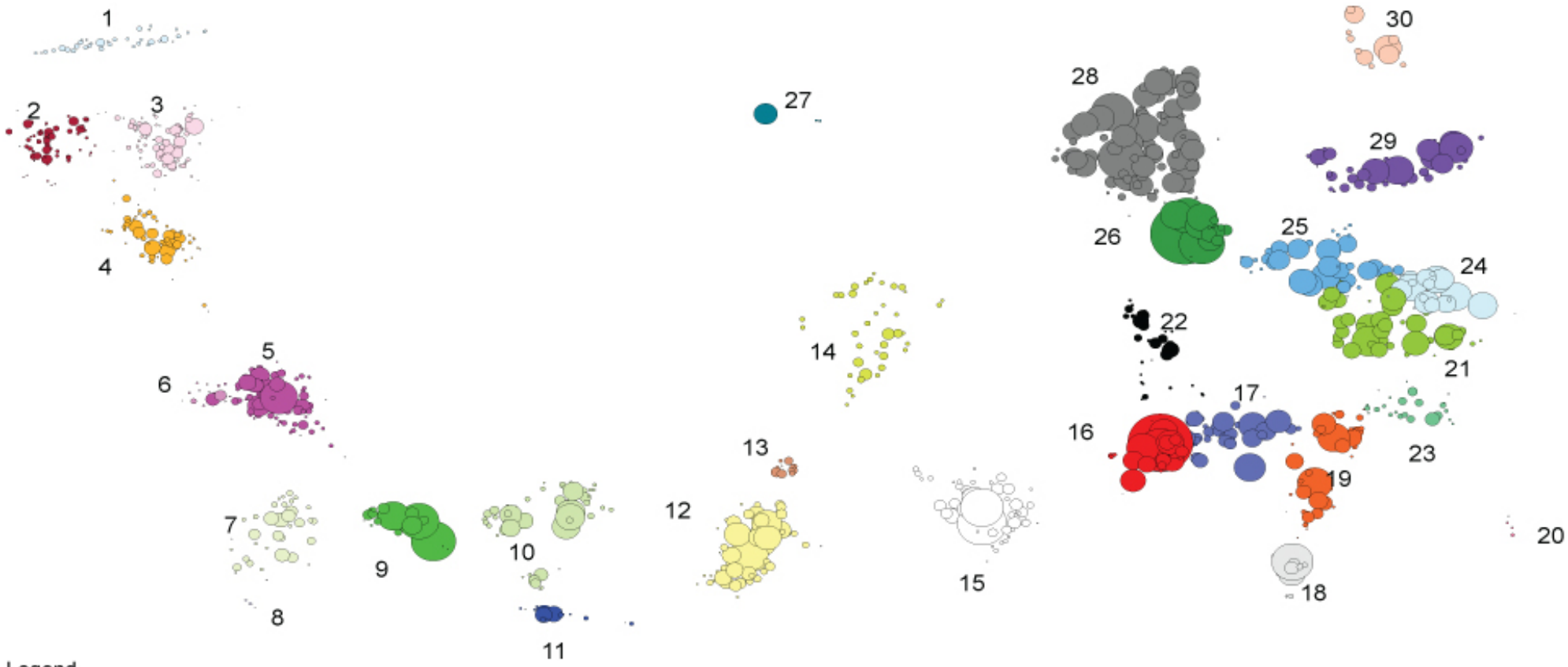

Legend
Bubbles represent individual products (SKU's)
Bubble color indicates submarket membership
Bubble Size indicates global competitive asymmetry (consideration frequency)
Submarkets are numbered 1 - 30

- ➔ Not a single LED-TV market: There are 30 submarkets, each dominated by a few products
- ➔ The strongest products overall (large bubbles) do not all directly compete against each other
- ➔ Competition is local to submarkets ➔ ***Managers must study individual submarkets to identify their strongest competitors***

Zoom-In on a Submarket

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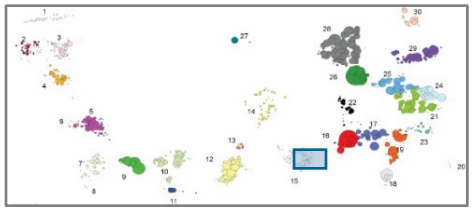
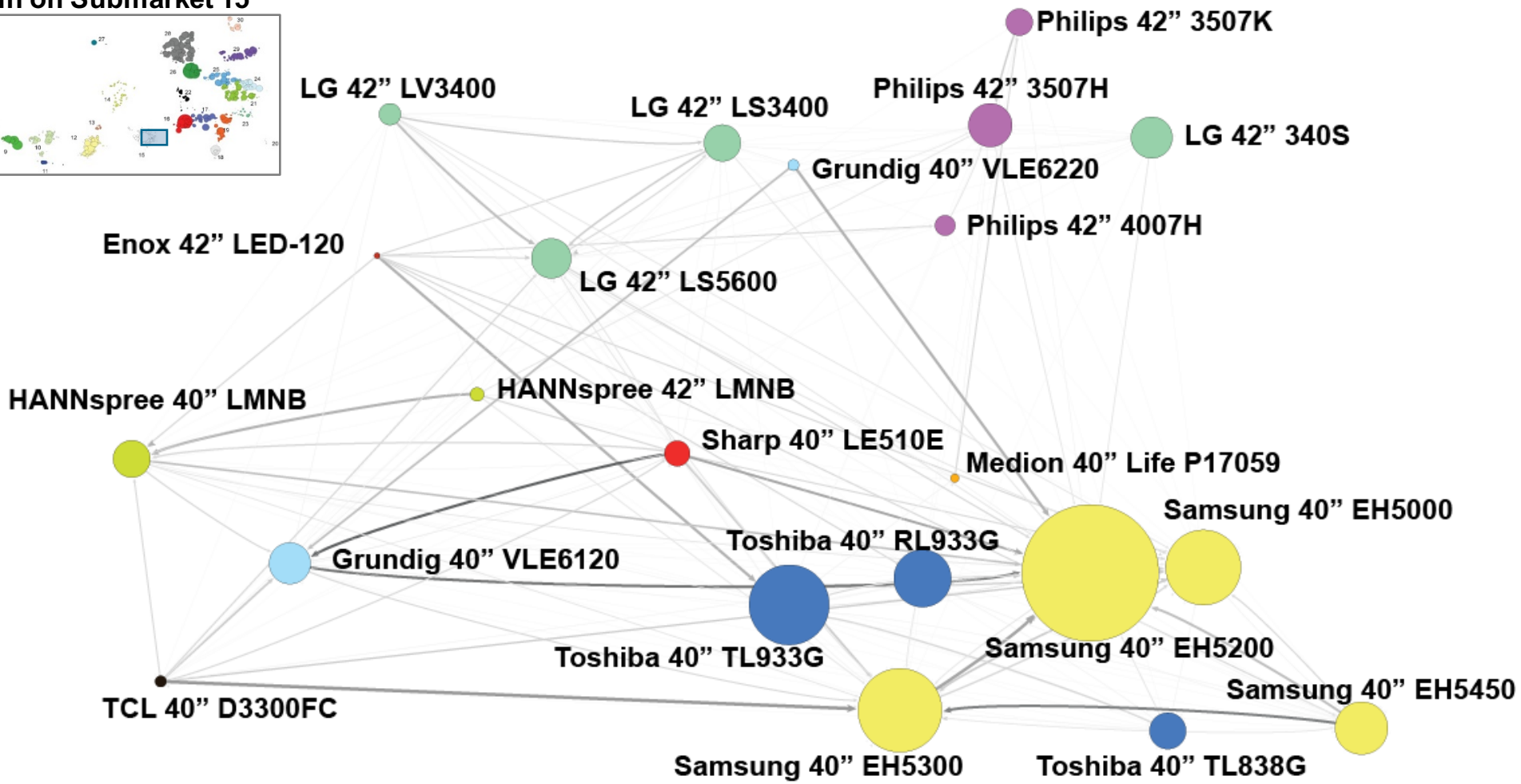
Zoom-in on Submarket 15





Legend
Bubbles represent products
Bubble colors indicate brand
Bubble size indicates global competitive asymmetry (consideration frequency)
Arrows indicate local competitive asymmetry (point at competitor)
Arrow weight indicates intensity of competitive relationship (the heavier the arrow, the greater the competitive asymmetry)

Zoom-In Further to Study Local Competitive Asymmetry

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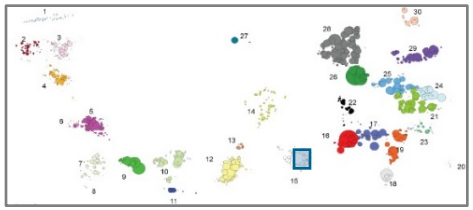
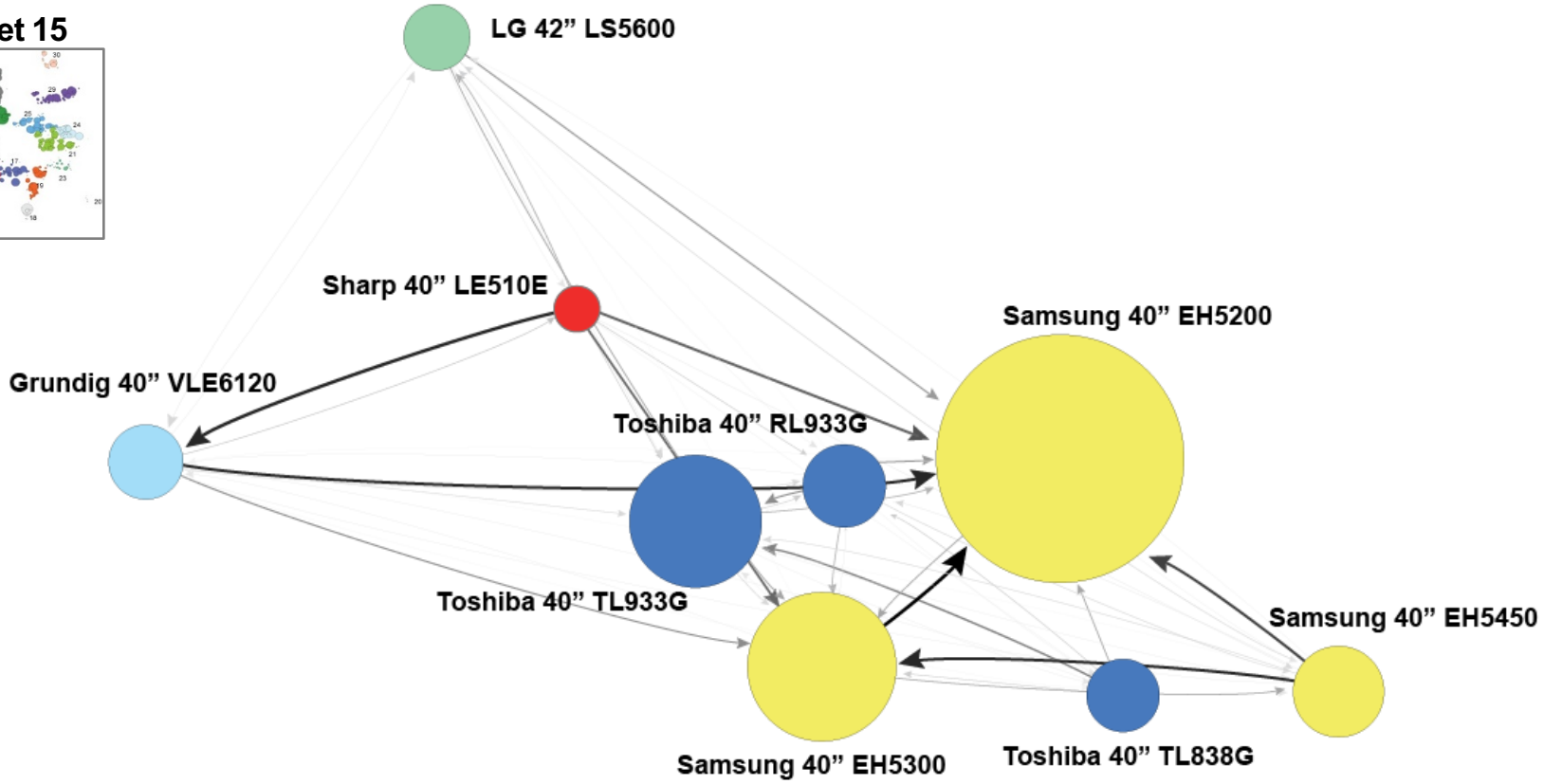
Zoom-in on Submarket 15





Legend
Arrows indicate local competitive asymmetry (point at competitor)
Arrow weight indicates intensity of competitive relationship (the heavier the arrow, the greater the competitive asymmetry)

- ➔ Strongest overall competitor in a submarket (bubble size) not necessarily strongest competitor of a product: ***Samsung 40" ED5200*** *not strongest competitor in terms of local competitive asymmetry (arrows) to* ***Sharp 40" LE510E***
- ➔ Closest competitors (by map distance) of a product not necessarily strongest competitors in terms of local competitive asymmetry (arrows): ***Sharp 40" LE510E's*** *strongest competitor is* ***Grundig 40" VLE6120****, not its closest neighbors*

➔ ***To correctly asses competition, managers must consider three things: (1) how close competitors are, (2) how strong competitors are overall, and (3) whether local competitive asymmetries are favorable or not***

Competitive Market Structure Map with Brand and Display Size

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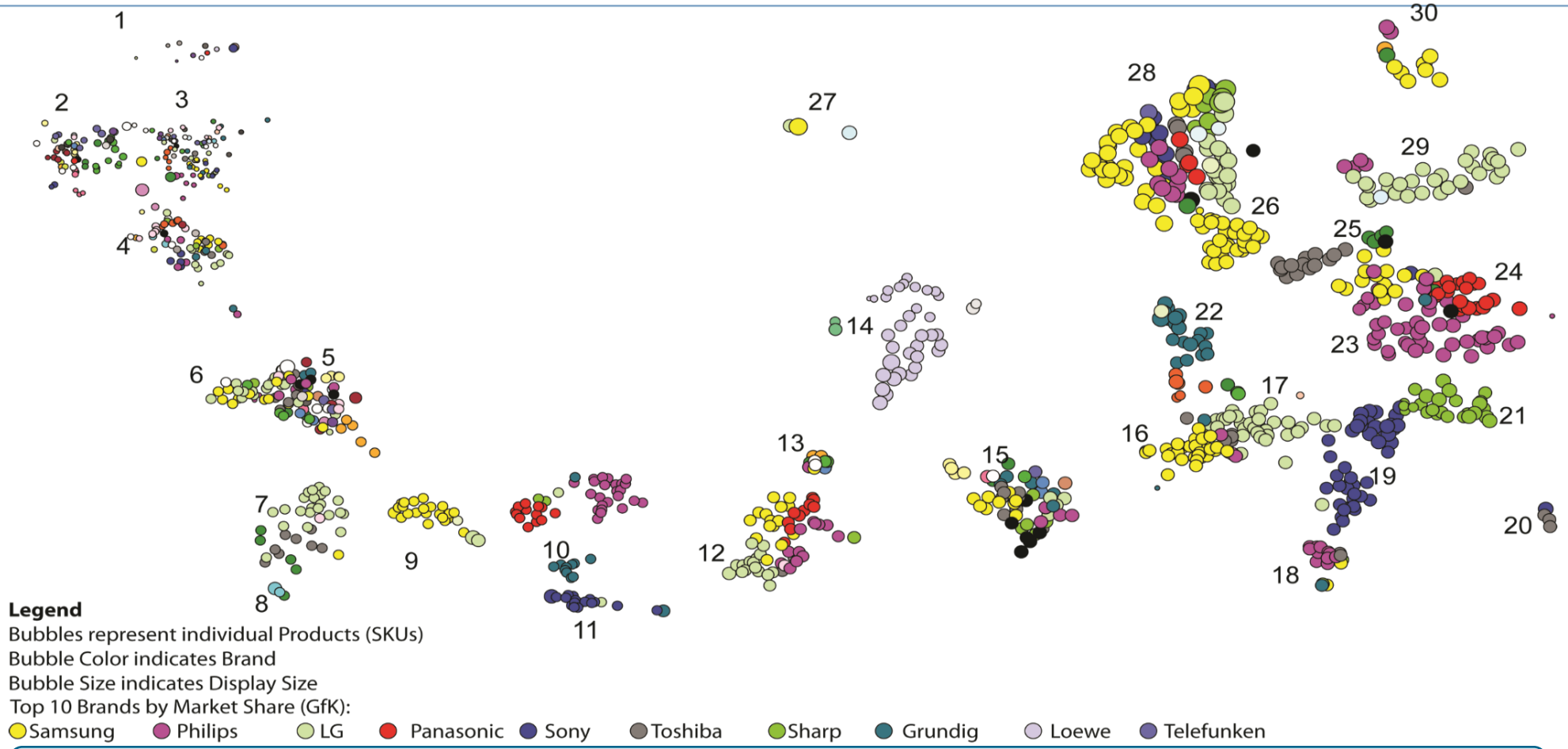

- ➔ Display size drives competitive market structure. Less known brands confined to smaller-display submarkets (left side of map) while top brands compete in larger-display submarkets (right side of map) ➔ ***Small brands must focus on launching larger display products to build market presence***
- ➔ Brands do not face same competitors (other brands) in all submarkets ➔ ***Managers must develop submarket-specific marketing strategies***
- ➔ Loewe isolation in separated submarket is early indication of later bankruptcy of Loewe ➔ ***Creating your "own market" is only good when you stay connected to full market in order to enter many consumer's consideration sets***

Competitive Market Structure Map with 3D Capability

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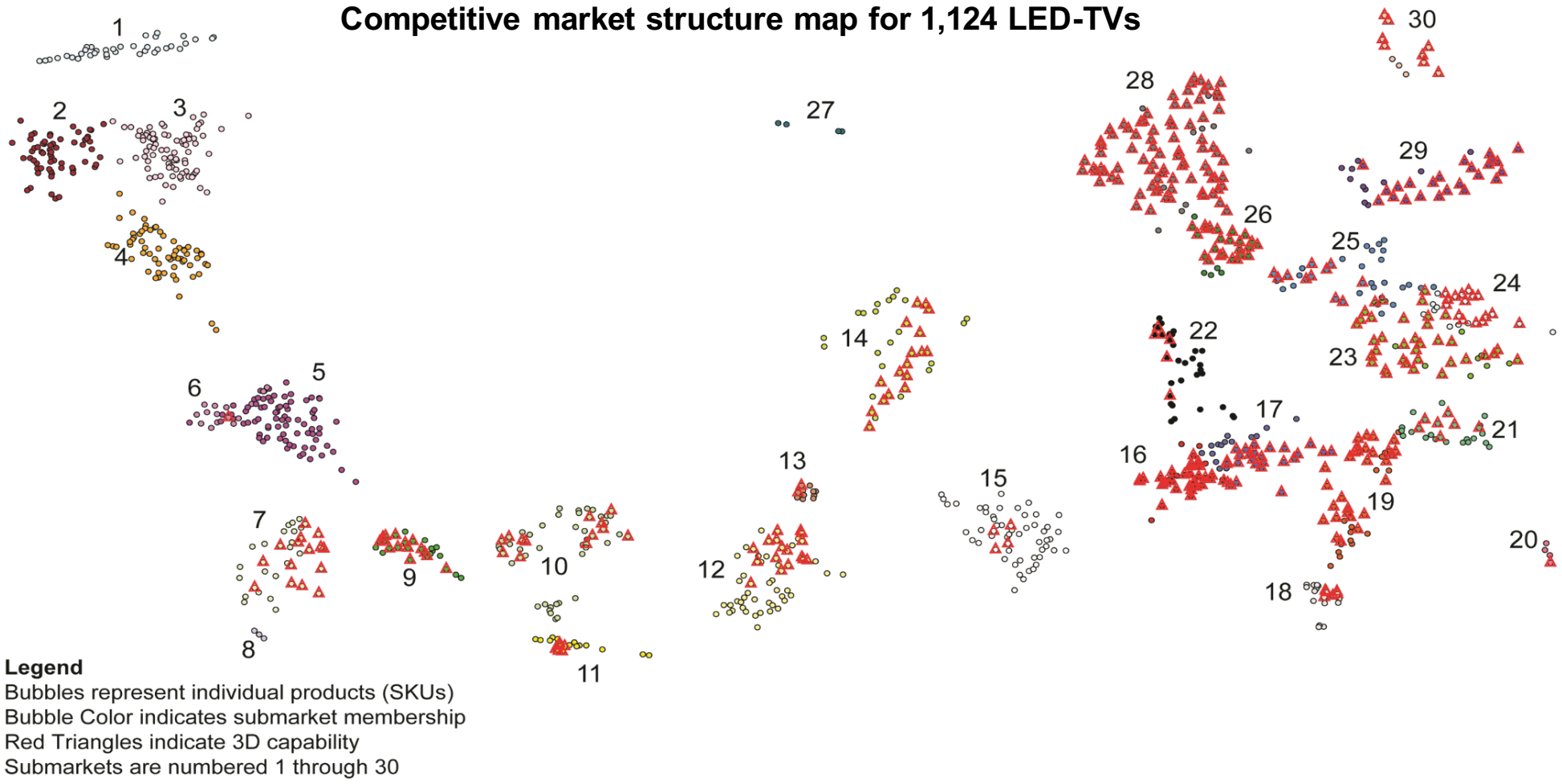

- ➔ 3D capability primarily among larger display LED-TVs
- ➔ 3D capability not a submarket defining product attribute
  → Cannot break-down the problem of competitive market structure analysis to smaller, a priori defined markets such as 3D-TV's in order to employ traditional approaches for visualizing competitive market structure

Managerial Implications

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Manufacturers

- Verify positioning: do products compete where intended?
  → if not, adjust communication and pricing
- Explore which product attributes drive market structure (e.g., create new submarkets)
  → focus R&D on key attributes
- Identify "spots" in the market with high consumer consideration but relatively few competitors
  → design and position new products to capture market share in these "spots"
- Determine which competitors (product and brands) you face in each submarket
  → align marketing activities towards specific competition in each submarket
- Determine impact of your marketing activities
  → map market regularly and track changes in market share, position and competitive strength (i.e., competitive asymmetry)

Retailers

- Identify dominant products of each submarket
  → serve all submarkets while listing less products
- Align inventory levels according to share of consideration (overall and within submarkets)
- When supply shortages of a product occur
  → identify and temporarily switch to its closest competitor
- Balance brand assortment within submarkets
  → reduce dependency on single manufacturers
- Determine which products in own inventory face strong (asymmetric) competitors
  → clear before they become shelf-warmers
- Focus advertising on "hot" submarkets / products (those receiving most consideration) to draw consumers to your store (shop)

Validation: Price-Comparison Site Data have higher External Validity than other Search Data

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Online Search → **What People Consider Buying** → **What People Buy**

$Online\ Search$ → $\hat{Y}$

Search Engine	Online Retailer	Price Comparison		Market Researcher
Google	amazon			GfK
Keyword search volume	*Frequency of "also viewed product list" inclusion*	*Frequency of consideration set inclusion*		*Online and in-store sales (units sold)*
0.698**	**0.347****	**0.753****	→	Y

** Correlation significant at 0.01 level (two-tailed); Sample consists of 549 LED-TV's (SKUs) matched across all data sources for September 2012 and covers 63% of total units sold according to GfK's Retailer Sales Panel

Empirical Comparison: DRMABS clearly Outperforms Traditional Mapping Techniques

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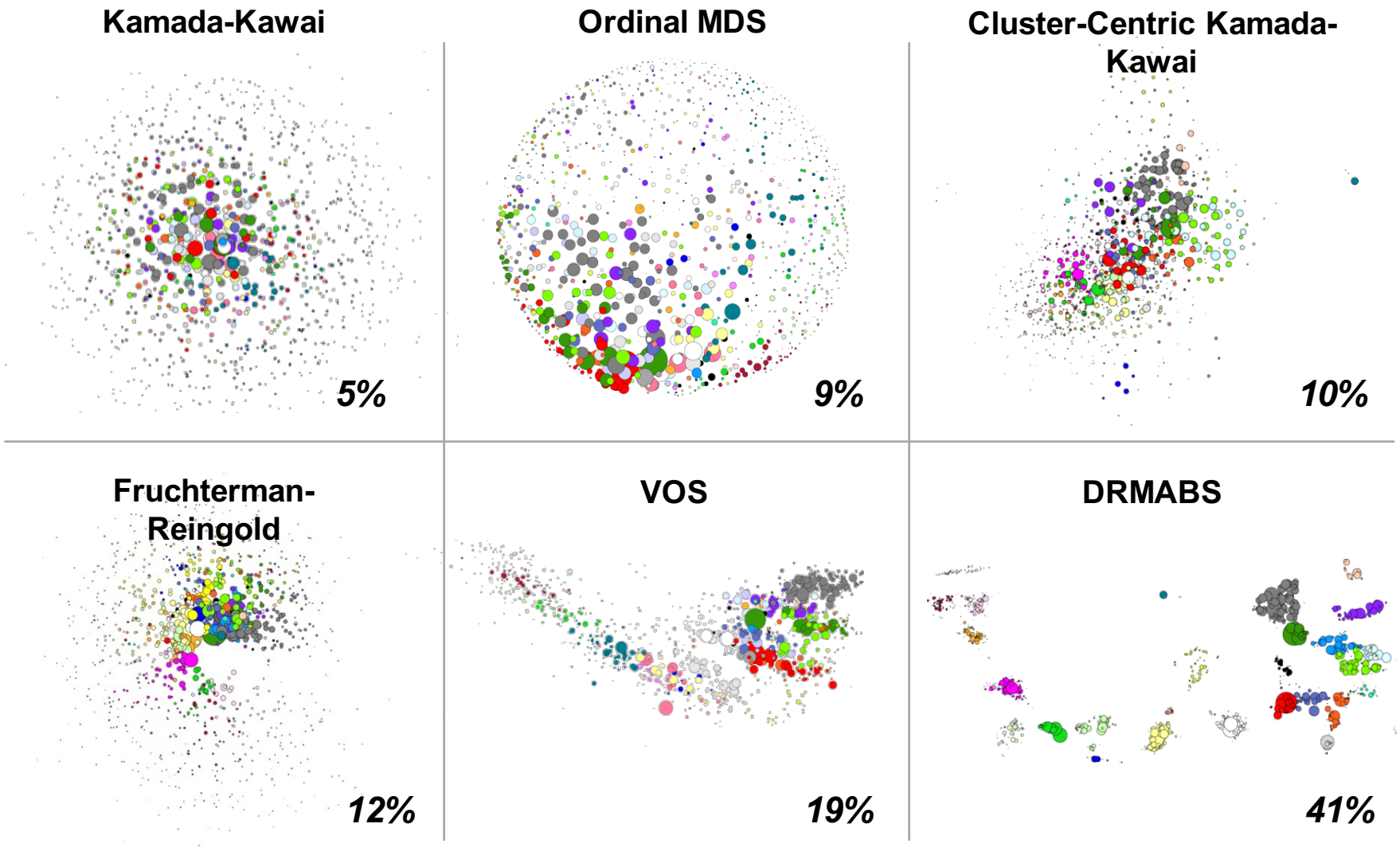

Bubble size indicates global competitive asymmetry (by consideration frequency)
Bubble color indicates submarket membership
Mean Top 10 Hit-Rate in % (tests whether products closest in map also have strongest competitive relations in Matrix of Joint Consideration)

Call to Action

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Look beyond traditional data sources when studying markets and competition:

→ Online search data are rich, abundant and recorded by practically every webserver in the world

Use own search data or approach operators of websites that attract consumer search in your market of interest:

→ Records of clickstreams are a byproduct when operating a website
→ Clickstreams can easily be extracted from existing server-logs
→ Even when you need to pay some money for such logs, the cost and time required for collecting data from thousands of consumers using traditional methods is a lot greater!

Use DRMABS as the starting point for understanding the competitive environment you face in large markets:

→ From there, drill down in areas that catch your attention to gain new insights
→ Develop informed and directed marketing activities given the competitors you face
→ Investigate the impact of your activities by employing DRMABS regularly (i.e., over time)