

PRODUCT DESIGN BRIEFS AS KNOWLEDGE- BASED ARTIFACTS OF CROSS-FUNCTIONAL COLLABORATION IN NEW PRODUCT DEVELOPMENT

Ian D. Parkman

Assistant Professor of Marketing
Pamplin School of Business
University of Portland
parkman@up.edu

Keven Malkewitz

Associate Professor of Marketing
Western Oregon University
malkewik@wou.edu

Cross-Functional, Team-Based New Product Development:

Cross-functional coordination within team-based development projects is an emphasis of contemporary research in business strategy, new product development, and design management

(Brown and Eisenhardt, 1995; Kim and Kang, 2008; Borja de Mozota, 2006; Verganti, 2003)

Functional areas from within and outside of an organization including **engineering, marketing, product design, user-experience, human resources, Information Technology, production manufacturing, distribution, operations**, and others

- However, the mere presence of cross-functional structures does not necessarily lead to better outcomes (Kim and Kang, 2008; Olson, Walker, Ruekert and Bonnerd, 2001; Cronin and Weingart, 2007)

Cross-Functional, Team-Based New Product Development:

Study of 43 Fortune 500 companies found “*tension*” between team goals and functional priorities, including: Competition over resources; overlapping responsibilities; conflicting personal goals; a lack of clear direction or priorities; and a lack of cooperation. (Wall and Lepsinger, 1994; Luo, Slotegraaf, and Pan, 2006)

The ability to effectively create, share, and employ cross-functional information and knowledge within NPD is related to the presence of **effective organizational structures** to “...*assist flows of information, facilitate teamwork, direct resources, and create alignment across functional areas.*” (Alavi, Kayworth and Leidner, 2005)



Strategic orientation describes firm-level philosophies for managing an organization’s internal and external forces for more favorable competitive alignment (Gatingon & Xuereb, 1997)

- Strategy = “***Stocks and flows of knowledge***” (Aaker, 1995)

Product Design Briefs as Evidence of Effective Organizational Structures supported by Strategic Orientation:



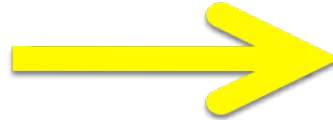
Knowledge-based Artifacts: Tangible, codified, durable, and sharable knowledge-based repositories of organizational culture, philosophy, routines, “know-how” as stories, arrangements, rituals, jargon, language, as well as diagrams, schematics, sketches, and prototypes (Ulrich and Pearson, 1998; Melewar, Basset and Simoes, 2006)

Product design briefs are documents employed during NPD that specify the many requirements of a project (Phillips, 2004; Bruce and Daly, 2007), such as objectives, descriptions of the target customers and competitors, product pricing, along with a wide variety of product attribute details-- e.g. shapes and colors, branding, materials, as well as holistic design attributes such as personality and meaning (Borja de Mozota, 2006)

Anecdotal use in Business strategy scholarship (e.g., Phillips, 2004; Bart and Pujari, 2007; Crawford and Di Benedetto, 2006) design (Jones, 1992; Bobrow and Dryzek, 1987; Acklin, 2011; Maciver and O’Driscoll, 2010) as elements of cross-functional coordination during NPD

Obligatory Nike Example:

Nike Air Max 1991 “visible Air” pocket



(Wall Street Journal, 2007)

Product Design Briefs as Evidence of Effective Organizational Structures supported by Strategic Orientation:

Goals of this Study:

1. Quantitatively define the types of information (i.e., *information elements*--e.g., words, text, phrases, concepts, ideas, figures, diagrams, sketches (Paas, Renkl, and Sweller, 2003) commonly contained in a representative sample of product design briefs
2. Empirically describe the use of product design briefs as knowledge-based artifacts of cross-functional coordination within New Product Development by examining the “*presence*” of *information elements* across three common functional areas;
 - **Design, Marketing, and Engineering/ R&D/ Development**

Research Method, Step 1:

Collect sample of product design briefs

Appendix B. Industry NAICS Codes For Sample Design Briefs

Firm	# of Briefs	NAICS code	Description
A	14	316219	Other Footwear Manufacturing
B	7	339920	Sporting and Athletic Goods Manufacturing
C	4	334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
D	5	332212	Hand and Edge Tool Manufacturing
E	2	333991	Power-Driven Handtool Manufacturing
F	1	339114	Dental Equipment and Supplies Manufacturing
G	12	316213	Men's Footwear (except Athletic) Manufacturing
H	1	336991	"Motorcycle, Bicycle, and Parts Manufacturing"
I	5	315228	Men's and Boys' Cut and Sew Other Outerwear Manufacturing
J	6	315239	Women's and Girls' Cut and Sew Other Outerwear Manufacturing
K	1	339113	Surgical Appliance and Supplies Manufacturing
L	6	337121	Upholstered Household Furniture Manufacturing
M	5	337127	Institutional Furniture Manufacturing
N	3	332214	"Kitchen Utensil, Pot, and Pan Manufacturing"
O	1	312111	Soft Drink Manufacturing
P	6	316991	Luggage Manufacturing
Q	1	316999	All Other Leather Good Manufacturing
125 total			

Final sample: 68 design briefs from 22 firms representing 17 NAICS industry codes

Research Method, Step 2:

Practitioner interviews and expert rating procedure

N = 138
information
elements

Initial list of device brief information elements drawn from interviews and related literature (n = 181)		
Effectiveness		Trend toward ease and simplicity
Risk		Usability
Health		Materials
Safety		Existing production facilities
Experience/Interactivity/ergonomics		Existing production capability
Technical Performance		Wear
Flexibility (flexible or smart)		Weight
Movements		Shape
W eight		Weight/size/complexity
Foreign (aesthetics, elegance, distinction)		Engineering
Sound		Performance
High end		Outfit
Cost		Material and design
Communication ability		Durability/Usability
"Smart" factor		Water and weather resistance
Style		Connectivity
Display of sophistication and style		Global
Fashion		Service level of purchase situation
Touch/Fall		Time required to purchase
Size		Length of Purchase Decision
Control		Ease of use or purchase location
Security		Quantity
Virtual		Virtual (Physical products, "Niche products", etc.)
Emotional		Use of market segments
Engagement		Identification of segments
Interactivity		Market segmentation of offering product
Execution method or use		Market potential
Facilities mechanism		Service
Personalization (aesthetics, smart red, make a statement)		Customized price point
Alternative (name, image, logo)		Brand
Facilitating (color, link or brand fit)		Feature set
Usability		Price point
Two-way surface products or brand aesthetics		Price/quality/feature
Brand history		Price comparison or product line price
Design language		Style
Facility		Single phase or multiple product
Uniformity		Quality
Gender		Weight/size/complexity
Descriptions or implies for consumers ("functional address")		Physical ability
Standard Use (frequency or frequency)		Fit and (shape)
Identify competitors		Accessibility
Level, magnitude of competitive success or appeal		LED/BLE
Differentiation and engagement		Technical Performance
Use by customer		Technical Specifications
Factory		Technology for technology's sake
Assembly		Technology for technology's sake
Price breakdown		Comparison with existing technology or materials
Expected life cycle		New technological innovations
Graphics		Info data (statistics, global)
Analytics		Customization
Customization		Process/track
Disruptive examples		Process/track
Substitutions		Process/track
Product Familiarity and New Market Entry		Process/track
Environmental analysis		Process/track



N = 51
information
elements

Final list of information elements refined through expert rating (n = 51)		
Size		
Style		
Experience		
Product performance		
Weight		
Weight/size/complexity		
Shape		
Form		
Style		
Customization		
Material		
Touch		
Control		
Security		
Virtual		
Emotional		
Engagement		
Interactivity		
Execution method or use		
Facilities mechanism		
Personalization (aesthetics, smart red, make a statement)		
Alternative (name, image, logo)		
Facilitating (color, link or brand fit)		
Usability		
Two-way surface products or brand aesthetics		
Brand history		
Design language		
Facility		
Uniformity		
Gender		
Descriptions or implies for consumers ("functional address")		
Standard Use (frequency or frequency)		
Identify competitors		
Level, magnitude of competitive success or appeal		
Differentiation and engagement		
Use by customer		
Factory		
Assembly		
Price breakdown		
Expected life cycle		
Graphics		
Analytics		
Customization		
Disruptive examples		
Substitutions		
Product Familiarity and New Market Entry		
Environmental analysis		

Example: "Target: [An] avid runner, who is highly involved with running, training for a sub-4 [hour] marathon, at 40+ miles per/ week. Lives in Urban area"

✓ **Product performance**

✓ **Prestige**

✓ **Materials**

✓ **Involvement**

✓ **Segmentation**

✓ **Intended use**

Research Method, Step 3:

Survey sample of (a) **Designers**, (b) **Marketers**, and (c) **Engineering/ R&D/ Developers**

N = 174 respondents from non-probability snowball sampling technique (Churchill, 1995)

Respondents were presented with randomized listings of 51 information elements and asked to rate the item's "**importance**" to their firm's "Most recent *product design brief*" on a likert-type scale from "1"-- *Never present* to "7"-- *Always present*

[illegible]

N = 51
information
elements

Respondents self-selected into one of three functional area categories: **Development/ R&D/ Engineering** (N = 45, 28%), **Design** (N = 47, 30%), or **Marketing** (N = 64, 40%)

Exploratory Factor Analysis (EFA) Results:

Table 1
Means and Standard Deviations of Information Elements Presence by Functional Area
(N = 153)

Factor	Information Element	Design		Marketing		Engineering/ Research & Development/ Manufacturing	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
1	Price point	2.74	1.11	2.67	1.21	3.00	1.17
1	Consumer segments	2.70	1.08	2.86	1.28	3.02	1.18
1	Product-level positioning	3.21	1.30	3.66	1.26	3.38	1.11
1	Technology	4.19	1.08	4.39	1.02	3.84	1.24
1	Multiple versions	3.40	1.21	3.44	1.33	3.29	1.14
1	Sale prices	4.04	1.08	4.14	1.01	3.76	1.25
1	Earlier products, brand	3.87	1.15	3.95	0.97	3.62	1.30
1	New introduction or product line continuation	3.98	1.07	3.69	0.91	3.47	1.24
1	Target dates	3.62	1.17	3.52	0.99	2.91	1.06
1	Project goals	4.30	1.10	4.47	0.71	4.13	0.94
1	Differentiation	4.04	1.10	3.92	1.04	3.40	1.14
1	Forecasts	4.32	1.09	4.09	0.89	3.60	1.16
2	Prestige	3.70	1.18	3.86	1.10	3.29	1.10
2	Status	4.13	1.19	4.17	0.98	3.91	1.18
2	Styling	4.04	1.20	4.11	0.80	3.44	1.16
2	Authenticity	4.06	1.24	4.17	0.77	3.58	1.23
2	Consumer meaning	2.68	1.20	2.84	1.26	2.71	0.89
2	Touch	3.36	1.03	3.34	1.06	3.56	1.06
2	Comfort	3.32	1.16	3.20	1.06	3.16	1.21
2	Sensory appeal	4.36	0.90	4.50	0.62	4.62	0.81
2	Emotional appeal	4.02	1.09	3.89	1.11	3.53	0.99
2	Firm-level positioning	3.77	1.15	3.91	1.11	3.13	1.04
3	Ergonomics	2.98	1.09	3.28	1.08	3.04	0.93
3	Product performance	4.09	0.97	3.98	0.88	3.98	0.92
3	Weight	4.17	0.92	4.17	0.98	4.09	0.90
3	Product quality	3.66	1.15	3.67	1.02	3.40	0.96
3	Workmanship	4.02	0.99	4.30	0.89	4.22	1.11
3	Technical specifications	3.11	1.13	3.38	1.20	3.42	1.20

Factor	Information Element	Design		Marketing		Engineering/ Research & Development/ Manufacturing	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
4	Consumer involvement	3.38	1.15	3.47	1.17	3.44	1.22
4	Product-user interactivity	3.47	1.30	3.64	1.13	4.11	0.93
4	Expertise	3.74	1.13	4.22	0.92	4.20	1.14
4	Originality	4.21	1.06	4.14	0.85	4.20	0.97
4	Competitor comparisons	4.13	1.03	4.16	0.95	4.16	1.02
4	Innovativeness	4.32	0.89	4.42	0.73	4.53	0.87
5	Tagline	4.23	0.94	4.50	0.62	4.20	0.87
5	Related promotions	4.17	1.07	4.42	0.71	4.13	1.06
5	Product life cycle	3.83	0.99	4.02	0.88	3.89	1.05
5	Distributors/ Suppliers	3.64	0.97	4.09	0.85	3.91	1.04
6	Design language	4.13	1.06	4.52	0.64	4.00	1.07
6	Associations	3.74	1.05	4.23	0.85	3.40	1.05
6	Graphics	3.91	1.06	4.27	0.72	3.80	1.06
6	Aesthetics	4.21	0.93	4.45	0.64	3.82	1.13
7	Product risk	3.23	1.24	3.20	1.07	3.20	1.08
7	Product safety	3.34	1.22	3.36	1.04	3.38	1.19
7	User health	3.53	1.04	3.55	1.14	3.64	0.88
7	Sustainability - product	4.04	0.98	4.22	0.92	3.89	1.05
7	Sustainability - process	3.91	1.10	4.33	0.76	4.18	0.94
7	Sizes	3.91	1.16	4.20	0.95	4.13	0.94
8	Materials	4.04	0.98	4.27	0.84	3.78	0.97
8	Production facility	4.04	1.04	3.89	0.89	4.24	1.00
8	Production capability	3.64	1.09	3.47	0.99	3.69	1.04

8 Factors explaining 77.4% of the variance (K-M-O statistic, 0.888; Bartlett statistic, 7267.65; significance = 0.000)

**With no items < 0.35 (Sethi and King, 1991)*

ANOVA Results and Discussion:

To address research goals of this study to (a) Quantitatively define the **information elements** commonly contained in representative product design briefs and, (b) Empirically describe the use of product design briefs as knowledge-based artifacts of cross-functional coordination

Categories of cross-functional knowledge identified by Hong, Doll, Nahm, and Li (2004)

1. Knowledge of Customers
2. Knowledge of Internal Capabilities
3. Knowledge of Suppliers
4. Knowledge of Firm Strategy

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

1. Knowledge of Customers

Refers to the extent that a firm encourages cross-functional collaboration in order to create a firm-wide, shared understanding of current customers' wants, needs, and demands.

Emphasis in business literature on heterogeneous understanding of market knowledge—i.e., in excess of that of their competitors (Moorman and Miner, 1997)

Factor 1

Factor 3

Factor 7

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

1. Knowledge of Customers

Factor 1 and Factor 3 capture a variety of relatively tangible and explicit information elements, including the “Price point” for the product, “Sales price”, “Versions” of the product, “Target dates”, “Goals” and “Forecasts”, “Ergonomics”, “Weight”, “Product quality”, “Workmanship” which broadly appears to be successfully communicated (**only 4 out of 24 showing significant statistical differences**). While Factor 7 contains information elements that characterize the “Risk”, “Safety”, “Health”, and “Sustainability” properties of the product as well as the corresponding development process.

- “Sizes” is confused...
- Designers rate “Product performance” (mean = 4.09) and “Differentiation” (mean = 4.04) *more importantly* than Marketers (mean = 3.98, mean = 3.92 respectively)

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	3.98*
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.80	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

2. Knowledge of Internal Capabilities

Refers to the extent of a shared understanding among the firm's design and engineering, process, marketing, manufacturing, and other functional capabilities among product development members.

A shared understanding of the strengths and weaknesses of an employee's functional area, along with adequate understanding of the strengths (and weaknesses) of other functional areas, can help create product development processes that maximize the capabilities of the firm as a whole (Atuahene-Gima, 2005)

- Factor 8

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

2. Knowledge of Internal Capabilities

Factor 8 contains information elements describing “Materials”, “Production facilities”, and “Production capabilities”. As there were no significant differences at the $p > .05$ level, our results suggests that broad agreement exists across functional areas as to the “importance” of these elements.

Indeed, the rating for “Materials” was among the highest means and agreement in our data (Design = 4.04, Marketing = 4.27, Engineering/ R&D/ Development = 3.78)

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Size	3.91	4.30	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** $p < .001$ ** $p < .01$ * $p < .05$

3. Knowledge of Suppliers

Describes the shared understanding across a firm's functional areas of their suppliers' design, process, and manufacturing capabilities. Practical issues of "Cost", "Flexibility", "Quality", "Dependability" (e.g., on-time-delivery) and "Speed to market" for a firm's product development projects.

Strong predictors of an efficient product development process, which leads to better firm performance (Koufteros, Vonderembse, and Jayaram, 2005)

- Factor 5

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

Knowledge of Suppliers

Factor 5 contains items describing two distinct constituencies within a firm’s supply network

Down-Stream (i.e., closer the end user) information elements such as “Tagline” and “Related promotions” appear more relevant to marketing, promotions, digital media, advertising, sales or public relations consultants, or what Verganti (2008) describes as ‘key interpreters’ of a product design.

- Marketers and Designers consider “Tagline” (mean = 4.50, mean = 4.23) to be more *important* than Engineers/ R&D/ Developers (mean = 4.20)
- While alternatively, Engineers/ R&D/ Developers rate **Up-Stream** “Product lifecycle” (mean = 3.89) and “Distributors and suppliers” (mean = 3.91) higher than Designers (mean = 3.83, mean = 3.64)

Table 2
ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

4. Knowledge of Firm Strategy

Captures the amount of shared understanding across cross-functional teams as to the firm's overall competitive advantages and product development strategies.

The ability of firms to manage flows of information between and among many concurrent and overlapping NPD projects is a distinct emphasis of contemporary business strategy and design management research (De Luca and Atuahene-Gima, 2007)

- Factor 2
- Factor 4
- Factor 6

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

4. Knowledge of Firm Strategy

Factor 6 defines a variety of marketing and branding elements: “Graphics”, Design Language”, and Aesthetics”. While Factor 2 describes a number of highly tacit and largely emotional and symbolic information elements, including “Prestige”, “Status”, Styling”, “Authenticity”, and “Emotional appeal”. Factor 4 captures dynamic/ active properties of a product, such as “Consumer involvement”, “Product-User interactivity”, and “Expertise”

This findings provide empirical support for Verganti’s (2003) concept of design-driven innovation as a strategy for creating complex “*product meanings*”

- For example, the ability to communicate specific “meanings” (e.g. status, excitement, or luxury) through a product’s form such as novelty and individuality of Apple’s original iMac computer as expressed through color, form, and aesthetics (Ravasi and Lojacono, 2005)

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** p < .001 ** p < .01 * p < .05

4. Knowledge of Firm Strategy

Notable results:

- “Status” ($F(2, 153) = 5.98, p > .01$)
- “Product-user interactivity” ($F(2, 153) = 6.95, p > .001$)
- “Originality” ($F(2, 153) = 10.05, p = .000$),

Means differences suggest that Engineer/ R&D/ Development functions consider elements traditionally understood to be aspects of Design higher than would be expected

- For example, “Touch” (mean = 3.56, relative to 3.36 for Designers and 3.34 for Marketers), “Sensory appeal” (mean = 4.62, relative to 4.36 for Designers and 4.50 for Marketers), and “Product-user interactivity” (mean = 4.11, relative to 3.47 for Designers and 3.63 for Marketers)

Table 2

ANOVA Results for Presence of Information Element by Functional Area (N = 153)

		Design	Marketing	Engineering/R&D/ Manufacturing	
Factor	Information Element	Mean	Mean	Mean	F-value
1	Consumer segments	2.70	2.86	3.02	
1	Differentiation	4.04	3.92	3.40	3.70*
2	Status	4.13	4.17	3.91	5.98**
2	Authenticity	4.06	4.17	3.58	4.60*
2	Consumer meaning	2.68	2.84	2.71	5.88**
2	Touch	3.36	3.34	3.56	3.49*
2	Comfort	3.32	3.20	3.16	
2	Sensory appeal	4.36	4.50	4.62	6.03**
2	Emotional appeal	4.02	3.89	3.53	4.35*
3	Product performance	4.09	3.98	3.98	3.24*
3	Weight	4.17	4.17	4.09	
3	Technical specifications	3.11	3.38	3.42	3.23*
4	Product-user interactivity	3.47	3.64	4.11	6.95***
4	Originality	4.21	4.14	4.20	10.05***
4	Competitor comparisons	4.13	4.16	4.16	3.67*
4	Innovativeness	4.32	4.42	4.53	6.58**
5	Tagline	4.23	4.50	4.20	
5	Related promotions	4.17	4.42	4.13	
5	Distributors/ Suppliers	3.64	4.09	3.91	
6	Design language	4.13	4.52	4.00	
6	Aesthetics	4.21	4.45	3.82	4.83**
7	Sizes	3.91	4.20	4.13	3.98*
8	Materials	4.04	4.27	3.78	

*** $p < .001$ ** $p < .01$ * $p < .05$

Conclusion:

Broadly: Despite their anecdotal importance, no previous empirical studies have examined product design briefs from the perspective of knowledge-based artifacts of cross- functional collaboration activities or precisely defined the contents of these documents

Our results provide clarity on the ways Design, Marketing, and Engineering/ R&D/ Development functions differ in their evaluations of the “*importance*” of information elements contained within product design briefs

And, differ in ways research may not have suggested– Which hopefully spurs further investigation

Implications for the Role of Design in Firm Strategy: Gotzsch (2006) and Aaker (2010), among others, describe the increasing pace of innovation and ruthless competition in mature product markets, where it is difficult for companies to compete solely based on functionality and product features and where attributes are easily copied by competitors-- Thus, helping firms uncover, codify, and communicate the needs, wants, desires, and “meaning” of their target consumers (Borja de Mozota, 2006) clarifies what Verganti (2003, p. 36) terms **Design- Driven Innovation** as, “...an innovation in which the novelty of a message and of a design language prevails over the novelty of functionality and technology”

In these contexts an emphasis on “meaningful” designs (e.g., through broad-based understanding and use of elements such as “Status”, “Authenticity”, “Emotional appeal”, and “Aesthetics”) becomes perhaps the sole avenue to sustained competitive advantage



Thank you very much.

I am happy to take questions and comments.