Growth and Development of a Body of Knowledge: 16 Years of New Product Development Research, 1989–2004*

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In this study, a content analysis was performed on 815 articles focused on new product development (NPD) published in 10 selected leading marketing, management, NPD, and research and development (R&D) journals from 1989 to 2004. Journals selected were a combination of leading journals in the discipline and publications that included NPD articles. NPD articles were classified by a series of key attributes including methodology employed, domains of knowledge utilized, and broad topics explored. The resulting data were then studied to discern trends over time or common characteristics within domains, methodologies, or journals. The study of NPD has grown since the Journal of Product Innovation Management *(JPIM) was launched in 1984. This study shows strong growth in the number of articles on NPD in each category of journal selected. The research in the articles has changed: The early focus on a few selected success factors or a staged development process has evolved and broadened over the 16-year period. More variables and more sophisticated models are being studied in NPD articles. The study found a continuing evolution in research topics and increased sophistication in quantitative techniques over the 16-year period. Overall this review of the NPD literature uncovers encouraging signs of a maturing discipline. However, there are concerns about continuing issues in methodology, insufficient study of service innovation, and continued focus on process characteristics instead of other antecedents of NPD success. The service sector seems to be understudied, even as the reality of a service economy is generally acknowledged. The call in a recent meta-analysis to focus more on market and product characteristics and less on process characteristics has not yet been heeded, even by marketing researchers.*

Introduction

New product development (NPD) has been a growing interdisciplinary area of research in recent years. A presentation at the 2004 Product Development & Management Association (PDMA) annual research conference noted that 170 articles were published during the first eight years of the *Journal of Product Innovation Management* (*JPIM*), a journal devoted to NPD, versus 208 articles in the eight most recent years studied, 1996–2003 (Biemans, Griffin, and Moenaert, 2004). A graph in the same abstract showed a dramatic rise in the number of academic articles citing *JPIM*: from an average of fewer than 40 a year in the eight years ending in 1991 to more than 400 a year in the eight years ending in 2003. The growth of citations was noted in two recent citation studies. In a cluster analysis and citation analysis of marketing journals,

JPIM was one of the 10 leaders in managerial marketing (Baumgartner and Pieters, 2003); in 2003 *JPIM* ranked 10th among all business journals, both management and marketing, in citations according to the Thomson ISI Impact Factor (Di Benedetto, 2004). The growth in articles and citations are evidence of an increasing interest in NPD issues in traditional marketing and management journals.

A study of 50 years of *Management Science* indicated significant growth in the three related areas of technological innovation, NPD, and entrepreneurship. *Management Science* published 70 articles on those topics in the five years ending in 2002 (Shane and Ulrich, 2004). Only a single article on any of the three topics had been published in the journal's first 10 years—from 1954 to 1963—and only one other five year period in the journal's 50-year history had more than 35 articles—half the recent five-year total (ibid.).

The most recent multijournal literature reviews of NPD research are two meta-analyses focused on the determinants of new product performance (Henard and Szymanski, 2001; Montoya-Weiss and Calantone, 1994). These meta-analyses summarized results in first 18 and then in 60 empirical studies. The meta-analyses then compared constructs used in the studies, tested the contribution of common variables to success, pointed out limitations in the research methods, and suggested future directions for research. Given the expanded body of knowledge, growth in research,

and variety of topics covered in NPD, a broad systematic review of the body of literature is clearly overdue.

This literature review has five main objectives: (1) to describe the growth of research and the research streams in NPD research during the 16 years from 1989 to 2004; (2) to classify the domains of knowledge and methods employed in research and show the changes and trends over the time period; (3) to compare and contrast contributions to NPD research published in management, marketing, and NPD or research and development (R&D) journals; (4) to note any apparent limitations in the research and progress on the issues raised in the earlier Montoya-Weiss and Calantone (1994) and Henard and Szymanski (2001) studies; and (5) to suggest future directions in NPD research.

The present article begins with an explanation of the journal selection and research methods used in the study. The results section comprises a discussion of growth in research, an examination of the level of analysis, analysis of trends in research design and analytical techniques, details of the data sets used in empirical studies, a study of knowledge domains used to study NPD, and an overview of topics of study and concludes with a cluster analysis to check for any other insights. Finally, the article reviews the suggestions of the two earlier meta-analyses against the trends observed in the analysis of the articles and concludes with methods issues and future research ideas for NPD.

Journal Selection and Research Methods

The authors chose to cover a 16-year period, from 1989 to 2004—from early-staged NPD process models through radical NPD. Given the relatively long time period, it was necessary to limit the number of journals included in this study. For the study, high-prestige journals were chosen to make sure that not only the leading edge of research but also journals that were most open to NPD research were included. The study examined recent journal rankings as well as journal citations and article abstracts published in the *JPIM*, the leading journal devoted to NPD. Seven of the ten journals selected for this review were included in a 2003 top-10 management citations ranking shown in Table 1 (Di Benedetto, 2004). Originally nine journals were selected: three each in management, marketing, and R&D/NPD. As the analysis got under way, it became clear that there were really four

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Table 1. Top 10 Academic Business Journals

Ranking	Journal Title
1	*Academy of Management Review*[a]
2	*Academy of Management Journal*[a]
3	*Strategic Management Journal*[a]
4	*Administrative Science Quarterly*[a]
5	*Journal of Marketing*[a]
6	*Journal of Consumer Research*
7	*Journal of Marketing Research*[a]
8	*Marketing Science*
9	*Journal of Management*
10	*Journal of Product Innovation Management*[a]

[a] Ranked by the Thomson ISI Impact Factor.

Table 2. The 815 New Product Development Articles by Journal

Journals/*Categories*	Number	Percent	Total (%)
Journal of Product Innovation Management	389	48	48
Research Technology Management	112	14	
R&D Management	74	9	
Non-*JPIM* R&D total			23
Journal of Marketing	32	4	
Journal of Marketing Research	36	4	
Industrial Marketing Management	46	6	
Marketing Total			14
Administrative Science Quarterly	14	2	
Academy of Management Journal	32	4	
Academy of Management Review	6	1	
Strategic Management Journal	74	9	
Management Total			15

categories of journals as the NPD journal *JPIM* was different from the R&D journals and accounted for a significant portion of the articles analyzed. So an additional management journal was added, *Strategic Management Journal (SMJ)*, which created a better balance of numbers of articles in the four categories.

JPIM is the leading journal focusing on new product development. The three marketing journals are the *Journal of Marketing (JM)*, *Journal of Marketing Research (JMR)*, and *Industrial Marketing Management (IMM)*. The four management journals are *Administrative Science Quarterly (ASQ)*, *Academy of Management Review (AMR)*, *Strategic Management Journal (SMJ)*, and *Academy of Management Journal (AMJ)*. Finally, the two R&D journals involved are *R&D Management (R&DM)* and *Research Technology Management (R/TM)*.

In Table 2 a preference for top-rated journals is noted. The marketing journal not included in the top-10 citations ratings, *IMM*, was often cited and abstracted in *JPIM*. *R&DM* and *R/TM* were highly ranked in two articles rating technology innovation management journals (Cheng et al., 1999; Linton and Thongpapanl, 2004) and were also prominent in the citations and abstracts of *JPIM*.

The list in Table 2 is in no way complete; it would be easy to add journals in each category. For example, if an additional journal was desired in each category the *Journal of the Academy of Marketing Science*, *Management Science*, and *IEEE Transactions* could be selected; if again an additional three were desired *Marketing Science*, the *Journal of Management*, and *Research Policy* could be included as well; the process could easily continue for multiple iterations. The intent of this effort was to find a representative sample of leading journals, not an exhaustive one. The

decision was made for this study that the 10 journals were representative of leading journals of the three disciplines and that the 815 NPD articles found in them were sufficient for a thorough and representative content analysis.

Content analysis applies an objective coding scheme to condense data and to make data systematically comparable, utilizing classifications and levels and units of analysis (Berg, 2004, p. 265). The 815 articles reviewed for this study were analyzed using content analysis, especially classification, similar to what has been used in other literature reviews including previous reviews of R&D and marketing (Griffin and Hauser, 1996) and international marketing (Nakata and Huang, 2005).

The articles for the study were chosen by reading the abstract: If, after reading the abstract, there was a question as to whether the article concerned NPD, then the full article was read. Articles on NPD were included if they were deemed to have academic merit, which operationally meant conceptual or empirical content. Generally any article in the management or marketing journals that was concerned with NPD was included in the study. "From experience" *JPIM* articles and similar articles in the R&D journals were the primary articles judged for academic merit; over half of these articles were included in this study.

Many of the classifications in the content analysis were relatively straightforward and easily determined by reviewing the articles, such as whether the article is empirical or conceptual; whether the analysis is

quantitative or qualitative; whether data were collected by a mail survey, interview, or case study; the sample size; and whether structural equation modeling (SEM), regression, or factor analysis was used for analysis. For analysis that was more subjective or required judgment, such as classifying the topic or the knowledge domain used in the article, the analyses were tested twice over a full range of journals to assure more than 90% agreement in the classifications. The details of the classifications are discussed with the analysis in the results sections. The Appendix presents the key to the classifications and was used during the coding of the 815 articles.

To view the change in categories over time, the 16-year period studied, 1989 through 2004, was divided into four quartiles: Q1 for 1989–92; Q2 for 1993–96; Q3 for 1997–00; and Q4 for 2001–04. Either the periods by year range or the Q1, Q2, Q3, Q4 nomenclature are used throughout the study to illustrate trends over the time period: Sometimes all quartiles are shown; sometimes the most recent four-year period, Q4, is simply compared to Q1 or the average for the entire 16-year period to provide a perspective on changes over the period.

Cluster analysis was also performed on the major classifications used in the content review of the 815 articles. Cluster analysis is "an objective methodology" to define homogeneous groups within a population (Hair et al., 2003, p. 469). Essentially the method allows the researcher to examine multiple dimensions simultaneously instead of just two or three at a time. The analysis was conducted to seek groupings of articles unrecognized in the frequency and cross-tabulation analyses.

Literature Review: Past Reviews

In their meta-analysis of determinants of new product performance Montoya-Weiss and Calantone (1994) voiced many concerns about the growing body of research in NPD. Comparisons of results were difficult due to "the wide variation in research designs, methods, and operationalizations of dependent and independent variables" (p. 397). They were concerned that a disproportionate set of the studies were in Canada due to the new product (NewProd) studies (Cooper, 1985). Other key areas of concern to Montoya-Weiss and Calantone were (1) too few factors considered in most studies (p. 411); (2) insufficient study of the environment, financial analysis, costs,

strategy, speed to market, and company resources (p. 412); (3) unreliable constructs (p. 414); (4) nonstandard measures of success (p. 400); and (5) incomplete reporting of results.

The meta-analysis raised several serious questions about the internal validity of NPD research due to (1) single respondents in surveys; (2) post hoc data with memory loss and halo effect; (3) lack of longitudinal studies; and (4) selection of survey respondents (Montoya-Weiss and Calantone, 1994, p. 414). Montoya-Weiss and Calantone recommended that studies employ multiple respondents within each project and urged longitudinal research efforts.

A later meta-analysis of empirical studies of antecedents of new product success (Henard and Szymanski, 2001) involved 60 studies through 1998. This later study echoed the concerns of Montoya-Weiss and Calantone (1994) that cross-sectional studies limited study of causality and led to memory and survivor bias; both also agreed that there were too few independent variables in most models and too many single-item constructs. Henard and Szymanski also argued that NPD models were too simple—nearly all of the research surveyed employed main effect models.

In their typology of antecedents of NPD performance, Henard and Szymanski (2001) found that the set of characteristics that had the least predictive power on product success, "process characteristics," continued to be the set of characteristics most used in the empirical studies. The continued popularity of the topic of diverse teams is an example of this phenomenon: Neither cross-functional integration nor cross-functional communication showed significant correlation with performance in their analysis. Henard and Szymanski called for more focus on (1) "product characteristics," especially product advantage and fit to customer needs; (2) "strategy" or marketing synergy; and (3) "marketplace characteristics," including market potential. They called for inclusion of environmental factors, more study of product quality, and more focus on ideation or opportunity recognition.

A presentation at the 2004 PDMA research conference focused on the 20-year history of *JPIM,* noting an increase in annual articles as well as issues published per year during the two decades. This study also showed a dramatic increase in citations of *JPIM* articles by other journals (Biemans, Griffin, and Moenaert, 2004). The functional areas most frequently citing *JPIM* were management of technology,

marketing, management, and operations research. Clearly new product development, the focus of *JPIM*, is a topic of growing interest in a number of areas of business research. This citations finding was consistent with *JPIM's* already cited 10th-place ranking among all business journals in citations according to the Thomson ISI Impact Factor (Di Benedetto, 2004). A recent review of technology innovation management journals stated that for topics "... traditionally linked to marketing, such as new product development, *Journal of Product Innovation Management* clearly is the best and most prestigious target journal" (Linton and Thongpapanl, 2004, p. 131).

Results

The Journals and Growth in Articles

As noted, journals in this study were grouped into four classifications: (1) *JPIM*; (2) R&D; (3) marketing; and (4) management. *JPIM* alone accounts for nearly half of NPD articles in the 10 journals for the 16 years covered. Due to the disparity in the number of articles in each group, within-group percentages are generally used in the comparative analysis. Table 2 shows a frequency breakdown of the 815 articles by the classifications and the individual journals.

JPIM accounted for 48% of the articles in the 16 years; the two R&D journals accounted for 23% of the articles; the three marketing journals accounted for 14%; and the four management journals accounted for 15%.

Figure 1 visually displays the steady growth in NPD articles in these 10 journals over the years of this study. The slope of the regression line for the change in total annual number of NPD articles over
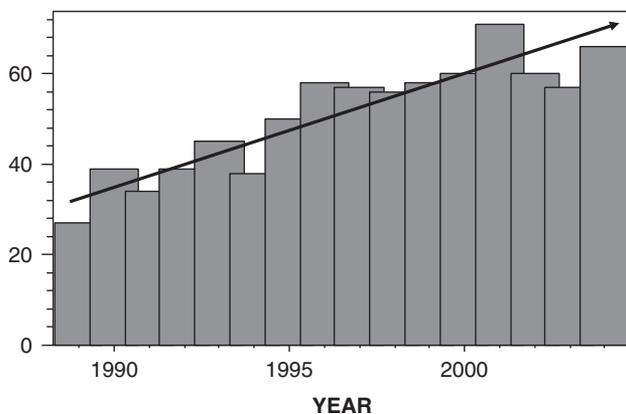
Table 3. Number of Total Articles and Percent of New Product Development Articles in a Four-Year Period

Years	JPIM	Management	Marketing	Research and Development	Total
Q4	97	57	32	68	254
2001–04	38%	22%	13%	27%	
Q3	107	28	42	54	231
1997–00	46%	12%	18%	23%	
Q2	105	23	26	37	191
1993–96	55%	12%	14%	19%	
Q1	80	18	14	27	139
1989–92	58%	13%	10%	19%	
Total	48%	16%	14%	23%	815

time is 2.4, which indicates that on average there was nearly an additional 2.5 new NPD articles in the 10 journals every year (adjusted $R^2 = .81$).

Table 3 shows the number of NPD articles in each journal classification for the four quartiles of this analysis. *JPIM*, management journals, marketing journals, and R&D journals have all increased the number of NPD articles over the period. However, the numbers of articles in the other journals have grown more swiftly than the number of *JPIM* articles, as can be seen by comparing the percent of NPD articles in *JPIM* (58% in the first four years) with the 38% of the final four years.

Table 4 shows a growing percentage of articles on NPD in the management and marketing journals included in this study. In the four-year period 1989–1992, NPD articles accounted for only 3% of all articles published in the three marketing journals used in this study: In the most recent quartile collected, that share had doubled to 6%. Similarly, the percentage of NPD articles in the six top-rated marketing and management journals doubled from 4% to 8%, and the share of NPD articles in the four management journals rose from 5% to 8%. This indicates that not only is the number of NPD articles per year growing steadily in the management and marketing journals but that their relative share of space in the journals is also growing.

Levels of Analysis

The articles were coded for three possible levels of analysis: the firm, a strategic business unit (SBU) of a firm, or the new product. The interesting pattern in levels of analysis was by journal category. *JPIM* was reasonably balanced with 38% of articles at the firm level, 14% at the SBU level, and 45% at the product level. The R&D journals were 66% firm level of

Figure 1. Number of NPD Articles in the 10 Journals Annually

Table 4. Number of New Product Development Articles and as a Percent of All Articles

	2001–2004		1989–1992	
Journal	NPD Articles	% of All Articles	NPD Articles	% of All Articles
Academy of Management Journal[a]	19	7	2	1
Academy of Management Review[a]	3	2	0	0
Administrative Science Quarterly[a]	1	1	6	7
Strategic Management Journal[a]	34	13	18	11
Management	57	8	26	5
Industrial Marketing Management	14	5	8	5
Journal of Marketing[a]	12	10	2	2
Journal of Marketing Research[a]	6	4	4	2
Marketing	32	6	14	3
Both	89	7	40	4
Six Top-Ranked Journals	75	8	32	4

analysis and 12% SBU; the management journals 61% firm and 16% SBU; whereas 60% of NPD articles appearing in marketing journals were focused on the product. There was little change in the level of analysis mix within journal types during time periods: *JPIM* was balanced; management and R&D were firm and SBU; marketing focused on the product. The only clear change over time was the focus on SBU in the management journal articles: In the previous highest four-year period (Q3) 11% of articles were at the SBU level; in the most recent (Q4) period 25% of the articles focused on an SBU.

The level of analysis results seems intuitive: Marketing would seem to focus more on the product level and management more on the firm or SBU level of analysis. As noted, marketing journals had 60% of their articles at the product level of analysis, and management had only 22%. The percentages for the R&D journals and *JPIM* (22% and 46%, respectively) are consistent with the citation findings of Linton and Thongpapanl (2004) that management of technology journals cite from the management literature but that the more eclectic *JPIM* has a marketing influence that sets it apart. As will be shown later, the product level of analysis focus of marketing researchers does not necessarily lead to a greater focus on product traits as independent variables.

Research Design, Analytical Techniques, and Data

In their study of literature on international marketing, Nakata and Huang (2005, p. 616) combined two typologies previously used to classify research design: conceptual versus empirical (Aulakh and Kotabe,

1993); and qualitative versus quantitative (Li and Cavusgil, 1995) to form four research designs. Nakata and Huang's (2005) combined typology was employed in this article. Empirical–quantitative designs, such as surveys and analysis, and conceptual–qualitative designs, such as literature reviews, are easily understood. Conceptual–quantitative designs use mathematical tools to develop new models. Examples of conceptual–quantitative designs in NPD research are often used in adoption or diffusion studies using conceptual models. Empirical–qualitative designs gather primary data through qualitative methods such as ethnography or in-depth interviews (Workman, 1993).

As illustrated in Table 5, 81% of the articles in the study presented results based on empirical data, and 61% of the articles were classified as empirical–quantitative articles, most commonly mail or phone surveys that were analyzed with statistical tools. However, 51 to 166 articles fell into each of the other three categories: (1) empirical–qualitative, data using qualitative analysis such as ethnography or case studies; (2) conceptual–qualitative, pure conceptual pieces or literature reviews; and (3) conceptual–quantitative, most commonly new formal models

Table 5. Research Design: Empirical/Conceptual and Qualitative/Quantitative[a]

	Qualitative	Quantitative	Total
Empirical	166	496	662
	20%	61%	81%
Conceptual	102	51	153
	13%	6%	19%
Total	268	547	815
	33%	67%	

[a] Chi-square: $p < .01$.

Table 6. Empirical Research: Primary versus Secondary Data[a]

Journal Type	Primary	Secondary
Journal of Product Innovation Management	198	30
Management	46	50
Marketing	70	19
Research and Development	69	14
Total	383	113
	77%	23%

[a] Chi-square: $p < .01$.

tested with secondary data. There has been a trend toward more quantitative and more empirical research, but it is a slow trend: The percentages have shifted only 1% to 2% from the first to final four-year period. Most of the empirical data in these articles are collected as part of the study.

Table 6 shows that 77% of the empirical conceptual studies collect new data. Among the empirical–quantitative articles there has been a shift in analytic techniques used through the period of this study. For example, there has been a dramatic growth in the application of multivariate statistical techniques. Table 7 shows that from the first four-year period to the most recent quartile, the percentage of empirical–quantitative articles employing multivariate techniques has increased from 44% to 77%. During the years 2001 through 2004, 43% of articles used either multivariate regression or SEM, the latter of which was used in 19% of articles versus 8%, 5%, and 2% in the preceding four-year periods, respectively.

More sophisticated analysis techniques, such as SEM, require large data sets. In the most recent four-year period the median sample size in all empirical–quantitative studies was 133, whereas the median for SEM studies was 192. The median sample size has increased slightly over the period of the study, though perhaps not as much as would be expected given the

Table 7. Analytical Techniques over Time[a]

	2001–04	1997–00	1993–96	1989–92
Uni/Bi-var (%)	23	32	46	56
Cross-Tabs	7	14	20	22
ANOVA	9	10	4	7
T-test	2	5	10	10
Multi-var (%)	77	68	54	44
Multi-Regr	24	25	15	12
SEM	19	8	5	2
CFA/EFA	8	11	15	7

[a] Chi-square: $p < .01$. ANOVA, analysis of variance; SEM, structural equation modeling; CFA, confirmatory factor analysis; EFA, exploratory factor analysis.

Table 8. Conceptual Levels—Most Recent Four-Year versus Entire Period[a]

	NPD Q4 (%)	NPD Total
Direct	35	49
Moderated	61	48
Feedback	4	2

[a] NPD, new product development.

increased popularity of SEM and other multivariate techniques: The median sample sizes were 110 in the first four-year period, followed by 125, 135, and 133, respectively. Response rates for the most recent four-year period, 41%, were essentially the same as the 16-year average. In summary, there has been a slight increase in data set sizes but perhaps less of a change than would be expected from the shifts in analytical techniques employed.

Sample sizes used in empirical–quantitative articles varied by journal types: *JPIM* had a median sample size of 167 for the most recent four-year quartile; the marketing journals had a median of 147 for the most recent quartile; the management journals had a median of 137; and R&D journals had a median sample size of only 86 from 2001 through 2004.

The present study also categorized models used in NPD research articles by their conceptual levels. A *direct* model primarily measured direct effects and simple constructs; *moderated* indicated moderating variables and interactions or multiple-item constructs; and *feedback* indicated models with feedback loops. Table 8 also indicates a move toward more sophisticated analysis in NPD articles.

Qualitative Studies

As noted earlier, the mix of research design has been fairly stable over time. In the most recent four-year period, 32% of the articles were classified as qualitative whereas 34% of articles over the full 16 years were so classified. Thus, there has been a slight decline in qualitative research. *IMM* and the two R&D journals, *R/TM* and *R&DM*, regularly publish case studies, so for this analysis those two journals are shown separately in Table 9. As the table shows, the percentage of qualitative articles in the three specified journals continues to be more than 40%, whereas in the most recent four years the percentage of qualitative articles in the other seven journals has declined to less than a quarter of the articles.

Table 9. Percentage of Articles Classified as Qualitative

	All 16 Years (%)	Q4: 2001–04 (%)	Q1: 1989–92 (%)
Research Technology Management, R&D Management, Industrial Marketing Management	45	43	46
The Other Seven Journals	29	21	34
Total	33	28	37

As the percentage of articles classified as qualitative has declined, Table 10 shows that the percentage of qualitative studies categorized as case studies has increased, the percentage of literature reviews has decreased, and there has been no significant increase in in-depth interviews.

Knowledge Domains

The primary and secondary knowledge domains drawn on in each article were coded. The eight knowledge domains listed as primary or secondary for at least 5% of the articles are listed in Table 11. There is clear overlap in the categories; for example, organizational behavior (OB) and management or OB and psychology could be lumped together. It was surprising to find finance as a primary knowledge domain for 4% of the studies. The R&D journals contained a number of articles evaluating a firm's NPD portfolio as a portfolio of real options, employing finance theory. Table 11 also clearly illustrates the interdisciplinary nature of NPD research.

Topics of Study

Two different schemes were used to categorize the articles. *JPIM* has 10 categories in its article-by-subject index. An article was assigned to an average

Table 10. Categories of Qualitative Methods over Time

Qualitative Method	Total	Q4	Q3	Q2	Q1
Case Studies	146	41	51	33	21
	55%	58%	65%	49%	41%
Literature Reviews	84	25	18	23	19
	31%	35%	23%	34%	37%
Interviews	16	4	4	3	4
	6%	6%	5%	5%	8%
Total	268	71	79	67	51

Table 11. Eight Leading Domains of Knowledge in New Product Development Research[a]

Knowledge Domain	% Primary Domain	% Primary + Second
1. New Product Development	35	47
2. Management and Strategy	21	43
3. Marketing	19	26
4. Exploratory or Atheoretical	7	7
5. Organizational Behavior	6	11
6. Finance	4	6
7. Psychology	3	6
8. Management of Technology	3	6

[a] Chi-square: $p < .01$.

of two subject categories by the editors, although several had as many as five categories assigned by the editors. The present study examined how the articles were assigned to *JPIM* subjects and applied a similar scheme to the rest of the articles analyzed, limiting the articles to their two most apparent topics. The result of the full tabulation of *JPIM*'s scheme is shown in Table 12. Since on average the articles were assigned to two categories, the total percentages would add to 200%. As Table 12 shows, over the 16-year period the top two *JPIM* classifications were dominant: 32% of articles were labeled *product development* and 48% *organizing for innovation*. These two classifications, especially *organizing for innovation*, indicate a focus on the process variables that Henard and Szymanski (2001) found to be popular but not powerful.

Organizing for New Product Development

Henard and Szymanski (2001) studied the impact of 5 product characteristics, 5 strategy characteristics, 11 process characteristics, and 3 marketplace character-

Table 12. Articles Classified by *JPIM* Scheme[a]

JPIM Subject	Number	Total (%)
Organizing for Innovation	**391**	**48**
Product Development	**258**	**32**
Strategy	**232**	**28**
New Product Planning	**165**	**20**
Technology Innovation	**181**	**22**
Market Analysis	115	14
Forecasting	109	13
Creativity	71	9
Concept	49	6
Industry Analysis	47	6

[a] Topics assigned to at least 20% are shown in bold.

Table 13. Ubiquity of "Organizing for New Product Development"

Journal Type	Total (%)	2001–04 (%)
Management (MGMT)	56	61
Marketing (MKTG)	54	65
Research and Development (R&D)	69	71
JPIM	32	34
JPIM–MKTG	27	38
JPIM–MGMT	41	33

istics as predictors of new product performance. As indicated by the number of characteristics, process characteristics—which included popular topics such as cross-functional integration and communication—had been the most studied. Yet their meta-analysis showed that process characteristics explained little of the variance in product performance. None of the process characteristics except *market orientation* was a significant variable in multiple regression tests. The significant variables from the multiple regression analysis were product advantage, product innovativeness, marketing synergy, technological synergy, market orientation, and competitive response intensity—variables indicating product characteristics and marketing analysis. Henard and Szymanski expressed surprise that so much attention continued to be placed on process issues such as functional diversity in NPD teams (p. 373). They urged more study on the variables shown to better predict the variation of NPD success and on product quality and the generation of new product ideas.

Table 13 examines whether the weight of evidence cited by Henard and Szymanski (2001) in their *JMR* article has decreased the focus on *organizing for NPD*. The table shows that organizing for NPD seems to be even more popular recently as the percentage of articles so labeled were higher in 2001–04 than the average for the entire 16-year period among all four

journal classifications. Ironically, marketing journals showed the largest increase, and the percentage of marketing journal articles focusing on organizing actually exceeded the percentage of management journal articles so focused in the most recent four years. In the last two lines of the table, this surprising result was double-checked by looking at the coding done by the editors of *JPIM*: Comparing *JPIM* articles written by lead authors identified as being a part of the marketing department of their school versus lead authors who were in management or strategy, once again it was discovered that the percentage of organizing for NPD articles by marketing lead authors increased dramatically and exceeded the percentage for management lead authors during 2001–04.

A More Detailed View of Topics: Streams of Research

In addition to the *JPIM* scheme, a more detailed classification system was developed while reading the articles. Such inductive classifications—developed as the content is studied—are an important tool of content analysis (Berg, 2004). Midway through the study the realization was made that too many categories were being developed, and the authors made a concerted effort to combine classifications. The result of this effort to keep the number manageable is shown in the Appendix as the 42 streams of research. Table 14 shows the eight most common streams of research for the 16-year period and the four four-year periods to note changes over time.

NPD success–failure factor studies were very popular in the first eight years of the period studied and accounted for 6% in the first four years and 9% in the second four-year period but for only 1% and 2%, respectively, for the final two periods. In comparison, studies of radical new products were dramatically

Table 14. Streams of Research

Detailed Topic	Total (%)	2001–04 (%)	1997–00 (%)	1993–96 (%)	1989–92 (%)
Teams–Integration	14	15	13	13	11
External Alliances	10	9	9	12	12
New Product Development Strategy	8	8	8	10	4
Development Speed	6	3	8	7	8
Radical Products	7	7	10	4	4
Ideation and Creativity	5	4	5	3	8
Success–Failure Factors	4	2	1	9	6
Staged Process	4	3	4	4	8

[a] Chi-square: $p < .01$.

Table 15. Double-Digit Peaks in Stream Percent of Articles

Double Digit	Number of Occurrences	Average Percentage	Percent $y+1$	Percent $y+2$
Single Year	13	12.0	3.7	4.4
Consecutive	6	12.8	5.3	3.4

higher in the last eight years of the study than in the first eight. Less dramatic, but still clear, is that external alliances for NPD were more popular in the first half of the 16-year period, whereas teams and internal integration were more popular in the most recent eight years.

Studies examining simple direct factors in success and failure would seem likely to be in permanent decline as more sophisticated models develop. Other topics like teams and integration remain popular over the entire period. Still others peak in popularity and then decline rapidly. Examining the annual numbers two topics—ideation and teams—were revealed that accounted for more than 10% of all articles in a given year, then dropped to zero the following year, only to return to double-digit percentages six and seven years later, respectively. Annual graphs were examined to try to find consistent patterns in the ebb and flow of topic popularity, but a typical shape failed to emerge. The 10% level seemed important as a potential peak: On 13 occasions a stream reached a double-digit percentage of NPD articles for a single year; 6 reached double-digit levels two years in a row; none more than two years in a row. The drop-off was often precipitous: On four occasions articles on that topic fell to 0% the following year. Table 15 shows the "10% effect."

It is cautioned here against reading too much into the 10% effect—an average of 3.7% or 5.3% is a meaningful drop-off, but articles are still being published. It is also interesting to note that on five occasions the topic returned to double-digit percentage levels—2, 3, 6, 7, and 10 years later.

Journal Differences

As already noted, *JPIM* was balanced on unit of analysis; the management and R&D journals focused on the firm and SBU; and marketing journals focused on the product. Table 16 illustrates the differences in knowledge domains used in the journals for studying NPD. (Since each article could be classified by up to two domains, percentages would sum to nearly 200%.) *JPIM* and the marketing journals use a fairly balanced mix of NPD, marketing, and management knowledge in their NPD articles. Management journals stress management and organizational behavior knowledge and theory. As noted previously the use of finance theory in the R&D journals was primarily NPD portfolio studies that employed option theory.

Comparing the journals in Table 17 by the streams of research also points to differences in their approaches. Marketing and management show two overlaps, teams and strategy; *JPIM* had two streams in common with management and one with marketing (and included *marketing*). The unique streams in marketing were radical new products and the launch; in management the most common were external alliances and integration.

International NPD

Of the 815 articles, 13—less than 2% of the articles surveyed—were classified as primarily concerning international or global NPD, which placed it 20th on the streams analysis. Another 19 articles were classified as having global NPD as a secondary classification stream. Examination of the data used in the empirical-quantitative studies over the 16-year period finds 76% of the studies used data from a single country. The trend does not appear to be toward more internationalization of surveys as 84% of the data sets in the most recent four-year period are single-country data sets.

Since the journals studied are American journals, another perspective on the degree of international

Table 16. Knowledge Domains in New Product Development Articles by Journal Category[a]

Journal Type	Domain 1	Domain 2	Domain 3
Management (MGMT)	MGMT 71%	Organization B 16%	NPD 19%
Marketing (MKTG)	NPD 39%	MGMT 32%	MKTG 31%
JPIM	NPD 45%	MKTG 34%	MGMT 26%
Research & Development (R&D)	NPD 73%	MGMT 51%	Finance 18%

[a] Chi-square: $p < .01$; NPD, new product development.

Table 17. Top Four Research Streams for the Journal Categories[a]

Number	All Journals (%)	*JPIM* (%)	Management (%)	Marketing (%)	Research & Development (%)
1	Integration 17	Integration 16	External 20	Strategy 21	Integration 25
2	Strategy 15	Strategy 14	Integration 17	Radical 16	External 17
3	Teams 12	Speed 11	Strategy 13	Teams 16	Teams 16
4	Radical 11	Marketing 10	Teams 10	Launch 15	Marketing Research 13

[a] $N = 815$ (up to two streams each).

flavor is the makeup of the single-country data sets, specifically what percentage are U.S. versus single-country data from other nations as summarized in Table 18.

There is no evident trend in the data: Throughout all the time periods 59% to 75% of the time a single-source nation is the United States, and 63% to 77% of the time the single source is either the United States or Canada.

Cluster Analysis

An exploratory cluster analysis was performed of the data set. Cluster analysis can be considered an extension of the series of cross-tabs that were already performed on the data. Cluster analysis is the name of "a group of multivariate techniques whose primary purpose is to group objects based on the characteristics they possess . . . . Each object is very similar to others in the cluster with respect to some predetermined selection criteria" (Hair et al., 2003, p. 473). For this analysis the two-step process in SPSS 12.0 was used, which is designed for large data sets with either categorical or continuous data. The two-step algorithm will either select an optimal number of clusters or will permit the user to choose the number. Since the data collected on the articles are primarily categorical, cluster analysis is not sorting by distances but by common attributes. Some data conversion was necessary: For example, to include the 10 *JPIM* categories in the cluster analysis it was necessary to create 10 binary variables for each category and code a value of 1 if that category fit a given article.

Table 18. Source of Single-Country Data[a]

Time Period	United States (%)	Canada (%)	Total (%)
2001–04	62	5	67
1997–00	75	2	77
1993–96	59	4	63
1989–92	66	10	76

[a] $N = 388$.

Solutions up to four clusters strictly followed the conceptual–empirical and qualitative–quantitative classifications shown in Table 5. When research design was not included in the variables for the clustering, a two-cluster solution broke the set into qualitative and quantitative studies.

Cluster analysis consistently indicated two key categorizations. The most important distinction was between qualitative and quantitative studies. This seems intuitive since so many of the items collected, such as sample size and statistical techniques, will vary significantly between qualitative and quantitative studies. It is interesting in light of the earlier discussion of Henard and Szymanski (2001) and the organizing for innovation *JPIM* topic that this topic was the other constantly important categorization in forming clusters, suggesting that articles focusing on the organization of the process are different.

Issues and Future Directions of NPD Research

Methods Suggestions from the Earlier Meta-Analyses

Many of the issues raised by Montoya-Weiss and Calantone (1994) have clearly been addressed. Speed to market and strategy were among the most popular identified streams of research in the articles. More sophisticated analytical techniques, especially SEM, suggest that constructs have improved as has disclosure of results. Multiple success factors are largely standard (Griffin and Page, 1996). However, there has been no increase in the use of some of the variables identified by Montoya-Weiss and Calantone and Henard and Szymanski (2001) for future study in NPD models—especially the environment, costs, company resources, ideation, product quality, customer fit, and marketing synergy.

Montoya-Weiss and Calantone (1994) questioned the internal validity of the variables in the NPD

Table 19. Single Informants and Cross-Sectional Surveys in Quantitative–Empirical Articles

Quarter, Years	Single Informant (%)	Mail Survey (%)
Q4: 2001–04	85	87
Q3: 1997–00	80	86
Q2: 1993–96	83	89
Q1: 1989–92	58	81

Table 20. New Service Development

	Service Focus	Service Data
Total	52	21
Q4: 2001–04	19	12
Q3: 1997–00	14	7
Q2: 1993–96	11	2
Q1: 1989–92	8	0

literature surveyed. The identified problems were (1) selection bias; (2) cross-sectional data; (3) post hoc questioning, or the halo effect and faulty memory; and (4) the use of single informants for dependent and multiple independent variables. Both meta-analyses suggested that the field employ multiple informants, longitudinal studies, and the use of historical data.

Longitudinal studies are rare, and there is no evidence of an increasing trend. There is no evidence to indicate a decline in single informant or cross-sectional surveys, as illustrated in Table 19.

The most recent four-year period had the highest percentage of single-informant empirical–quantitative studies and a reasonably steady 87% cross-sectional mail surveys. There were no discernable trends in other types of studies such as experiments or long-itudinal studies. Although many concerns have been addressed, the ones raised in both cited meta-analyses of antecedents of new product success about survey design and model construction are still valid. Henard and Szymanski's (2001) critique of most NPD models as main-effect models remains for the journals studied as the present study found that only 4% of the models in empirical studies have any type of feedback loop and still classified 35% of NPD models as direct models in 2001–04.

New Service Development

Perhaps the most surprising finding in this content analysis of new product development was the paucity of research on new service development, clearly illustrated in Table 20.

Products include both goods and services (Kotler, 2000, p. 11). A widely discussed 2004 *Journal of Marketing* article called for a new paradigm of marketing: All marketing is service marketing (Vargo and Lusch, 2004). Since services have been growing much faster than the economy as a whole and that services account for the majority of the gross domestic product (GDP) of developed nations, it would seem likely that research on new service development would be a

significant share of new product development research. Therefore, it should be surprising that only 52 of the 815 articles in the data set even included services and that only 21 articles focused on new service development. Growth in articles on service development has been fast in percentage terms but only because the initial levels were so small: 12 of the 18 articles focused on new service development were published from 2001 to 2004. This number (12) represents less than 5% of the articles of period Q4.

A review of the new service development literature found that three groups "must be managed in an effective development project: (1) the development staff; (2) the customer-contact staff; and (3) the customers" (Johne and Storey, 1998, p. 203). The inclusion of these three groups in the development process indicates some promising and interesting areas of future research in organizing new service development.

Conclusion

The new product development literature has grown and evolved over the 16-year period studied. Research topics and domains have changed in relative popularity as new issues have arisen and others may have been sufficiently studied. Furthermore, the penetration of NPD subject matter into top journals outside of the specific domain of NPD has been increasing. The eclectic mix of levels of analysis and core knowledge areas brought to bear on the study of new product development is an asset to the field and insures that it is studied from different perspectives. These are positive signs for a maturing discipline.

This study has illustrated seven key observations or trends in the growth and development of the new product development body of knowledge:

1. The number of NPD articles appearing in leading journals has grown over the 16-year period in absolute annual numbers as well as percentage of articles published by the surveyed journals.

2. An increasing percentage of NPD articles appear in journals other than *JPIM*.

3. Each of the four categories of journals has a unique mix of level of analysis and core knowledge areas from which its NPD articles draw.

4. The use of multivariate techniques, especially SEM, has grown in NPD studies.

5. Model complexity in NPD studies has also increased over the 16-year period, though most models continue to be main-effect models.

6. Surprisingly, single-informant and single-nation data collection have actually grown in frequency over the 16-year period.

7. Articles on new service development are more frequent but are a small portion of the total set of articles.

This study would project to see a dramatic increase in research on new service development in the years ahead. Much of the new NPD knowledge in the next 16 years will likely develop from studying unique aspects of new service development. Both conceptual and empirical analysis of new service development and both qualitative and quantitative techniques should be employed in the effort to understand the unique characteristics of the new service development.

Following the meta-analysis of Henard and Szymanski (2001) there should be more examination of product characteristics, marketplace characteristics, and strategy synergy as well as product quality as predictors of new product performance. It is surprising to see marketing faculty and marketing journals focusing so much attention on organizing for innovation when traditional marketing variables were shown in this meta-analysis to be both more powerful and understudied antecedents of NPD success. The same authors' suggestion of more study of the ideation process also seems vital to understand the NPD process more completely, yet according to the analysis articles addressing ideation have declined from 9% in Q1 to 6% in Q4.

As the field continues to grow, evolve and mature, new research methods of data collection need to be developed, or the NPD field will continue to be hampered by the validity questions raised in the meta-analyses. The dominant form of quantitative empirical research—the single-informant, cross-sectional survey where the data come primarily from recall—remains subject to memory and survivor bias as discussed in two earlier reviews. Montoya-Weiss and Calantone (1994) called for large-scale, longitudinal studies of new product development a decade ago. As Henard and Szymanski (2001) pointed out, no assumptions of causality are possible from cross-sectional data; replication of results does not help. New product development is an area of sufficient importance to merit special efforts to test causality through longitudinal studies. A promising example of a longitudinal NPD study is the Radical Innovation Research Program at Rensselaer Polytechnic Institute, which focuses on radical innovation in a small group of large innovative firms (O'Connor, 1998).

There is a clear need for large-scale, broad examinations of new product development: something similar to the ongoing Panel Studies of Entrepreneurial Dynamics project (Reynolds, 2000). One or more of the major organizations interested in NPD research, such as the PDMA, Marketing Science Institute, or the Academy of Management, could work with industry and academia to get such an effort under way. Effort must be also be made to employ multiple sources when collecting data and to test for interactions and moderators between variables. The research methods issues raised in two successive meta-analyses of antecedents of new product success still must be addressed.

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Appendix. Key to New Product Development Literature Review Content Analysis

Level of Analysis (3 + other)
- Firm
- Small Business Unit (Program/Teams)
- Product (Project/Team)
- Other (e.g., environment)

JPIM Classifications (10)

Technological Innovation	Organizing for Innovation	Concept
Forecasting	Industry Analysis	Product Development
Strategy	Creativity	
Market Analysis	New Product Plan	

Streams of Research (42)

Product Strategy	Launch Strategy	Pricing
Cross-Functional Teams	Leadership	Entrepreneurial Small to
Integration of Functions	Marketing	Medium-Size Enterprises
Accelerating New Product	Innovativeness	Project Management
Development (Speed)	Escalation of Commitment	Competitor Co-op
Alliances with Customer	Methodology and Metrics	Forecast
Support	International and Global	Experience
Disruptive/Radical	Portfolio	Build or Buy (B or B)
Ideation	High-Tech Products	Pioneer or First Move
Staged Process	Turbulent and Rapid	Networking
Success/Failure (Few, Direct)	Services	Bus Cycle
Adoption	Management of Technology	Environment
External	Champion	Communication
Communciation/Integration	Supply Chain	Education
Organizational Learning	Design	
Market(ing) Research	Process	

Research–Design

Research–Design	**Research–Detail**	
Conceptual-Qualitative (C-Qual)	Literature Review (Lit Rev) Experience (if data to Empirical)	
Conceptual-Quantitative (C-Quant)	Modeling, no secondary data (Mod-no) Modeling, secondary data (Mod-sec) Content Analysis	
Empirical-Qualitative (E-Qual)	Case study In-depth interviews Ethnography Focus Groups	Other (Delphi)
Empirical Quantitative (E-Quant)	Mail Survey Personal survey Phone Survey Internet	Historical Experiment

Variables	Analytical (More than one at times: Summary Categories)	
Univariate/Bivariate	Cross Tabs	
	T-test	
	Analysis of Variance (ANOVA)	
	Simple Regression	
	Correlation	
	Content Analysis	
Multivariate	Analysis of Covariance (ANCOVA)	Multiple ANOVA/ Multiple ANCOVA (MANOVA/MANCOVA)
	Multiple Regression (e.g., 2/3-stage, Log, Hier)	
	Discriminant Analysis	
	Conjoint Analysis	Meta-Analysis
	Cluster Analysis	Model Testing
	Confirmatory Factor Analysis (CFA)–Exploratory Factor Analaysis (EFA)	
	Hazard	
	LISREL/Structural Equation Modeling (SEM)	
	Diffusion	
	Path Analysis	Game Theory
	Other (e.g., Monte Carlo, Poisson)	

Knowledge Domains (18)

New Product Development	Finance or Options	Design
Management Theory	Psychology	Network
Marketing Theory	Atheoretical/Exploratory	Communication
Organizational Behavior	Strategy	Options
Management of Technology	International	Sociology
Supply Chain	Economics	Other

Conceptual Framework Models (3)

Direct	Direct relationships with simple or single-variable constructs
Moderated	Moderating factors, more complete constructs
Feedback	Complex models with multiple moderating effects or feedback

Data Details

Survey	Y or N
#IND	Number of industries surveyed
IND-list	List of the industries
#Nations	Number of countries survey
Nation-List	List of the nations surveyed
Respond#	Number of respondents in each firm or project surveyed
% Respond	Response Rate, if reported