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New Product Development (NPD) Success Factors: A Review of the Literature

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Abstract

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This paper reviews the literature on managerially actionable new product development success factors and summarises the field in a classic managerial framework. Because of the varying quality, breadth and scope of the field, the review only contains post-1980 studies of tangible product development that are of a rigorous scientific standard. Success is interpreted as a commercial success.

The field has gained insight into a broad set of factors that vary in scope, abstraction and context. Main areas that contribute to NPD success are top management support exhibited through resource allocation and communicating the strategic importance of NPD in the organisation. The right projects need to be selected for investment at the beginning of the process and should be aligned to the organisation's internal competencies and the external environment. The NPD process should use cross-functional teams and a competent project champions. Marketing research competency is crucial, as an understanding of the market, customers and competitors is repeatedly highlighted. Product launch competency was also consistently shown to be important. In terms of controlling the NPD process, strict project gates are required to maintain control.

Table of contents

1. Introduction

This paper provides a summary review of publications on new product development (NPD) success factors, and develops an organising theoretical framework for their presentation. This body of publications is voluminous (Calantone and Di Benedetto, 1990; Jensen and Harmsen, 2001; Song and Montoya-Weiss, 2001), with studies often employing vague constructs or varying innovation-related definitions (Garcia & Calantone, 2002; Kessler and Chakrabarti, 1996; Poolton and Barclay, 1998) and weak scientific methods (Balachandra and Friar, 1997; Ernst, 2002; Story et al., 2001). Nevertheless, insight into a broad set of factors has been attained (Story et al., 2001; Huang et al., 2002), and so it follows that the review needs to be highly discriminatory. It therefore only contains empirical studies that, published since 1980, follow commonly-accepted social scientific standards in data collection, data analysis and results reporting on samples of statistical significance. With these discriminatory factors, the end-result is a more parsimonious review, the results of which are more accurate, generalisable, and valid in accordance with common scientific quality metrics (e.g. Black, 1999).

The review contains only those studies that have sought to elicit, confirm or explain the relationship(s) between managerially actionable factors and NPD success or failure in the single firm. Studies of general programme-level success factors and studies focussed on specific NPD activities such as product launch and management are included, but research into new service development (NSD) is not. Success or failure is accepted as per the individual study's definition so long as there is a link to commercial success.

Following this introduction, the paper's methodology is outlined. Subsequently, the body of the paper reviews the NPD studies in an original framework for presentation. This framework provides order and eases comprehension. Finally, the paper provides a synoptic conclusion.

2. Methodology

This section reports the process and choices made in collecting, selecting and reporting on the NPD success factor literature.

2.1 Sources

The NPD literature is diverse both in its approach (Brown and Eisenhardt, 1995) and in its publication venues (see Table 1). Three summary articles were used as a starting point (i.e. Balachandra and Friar, 1997; Brown and Eisenhardt, 1995; Ernst, 2002). It should be noted that although Ernst (2002) has a publication date of only three years ago, he only includes one study, that meets the current criteria, which is dated post-1997. As such, the field of literature post-1997 remains uncharted. Therefore, these summary article references were complemented with a refereed article search in EBSCO Online and Proquest Business Source Premier, with specific emphasis on post-1997 publications.

It should be noted that all "consulting company" research (e.g. The 1991 Arthur D. Little Survey on the Product Innovation Process; Kuczmarski & Associates Inc. Winning New Product and Service Practices for the 1990s Study), which has not been published in a refereed, scientific forum has been excluded.

Table 1 shows the publication venue of the studies reported in this paper. It should be noted that a single study is often reported in several articles. See for example Cooper's work: he is author or co-author of 15 of the publications in Table 1, yet he only cites six individual studies (in fact 35 articles published on the basis of his six studies were identified, but 20 were not included to avoid repetition). This approach, which is not uncommon in NPD success factor research, creates a disparity between the number of publications and the number of studies. However, as can be seen, the majority of key NPD studies are published in a limited number of journals, with a preponderance being published in Journal of Product Innovation Management (20) and Research Technology Management (5). Although when taking into account the work of Cooper, the Research Technology Management total falls to just one. So in summary the publications are actually spread, with Journal of Product Innovation Management being the central venue.

Table 1: Publication venues of studies in the review

Journal	**Number of articles. (#) = publication by Cooper**
Australian Journal of Management (AusJM)	1
European Journal of Innovation Management (EJIM)	1
European Journal of Marketing (EJM)	3 (3)
IEEE Transactions on Engineering Management (IEEE)	1
Industrial Marketing Management (IMM)	3 (2)
International Marketing Review (IMR)	2 (2)

Table 1: Publication venues of studies in the review

Journal of Marketing (JoM)	1 (1)
Journal of Marketing Management (JoMM)	2 (2)
Journal of Marketing Research (JoMR)	1
Journal of Product Innovation Management (JPIM)	19 (1)
Journal of Small Business Management (JSBM)	1
Management Science (ManSci)	3
Marketing Science (MarSci)	1
R&D Management (R&DMan)	3
Research Management (RM)	1
Research Technology Management (RTM)	5 (4)

2.2 Terminological boundaries

Product

Many researchers (e.g. Johne and Storey, 1998; Larson et al. 1991) suggest that the field of NPD contains both the development of tangible and intangible products. There is no certain consensus as to whether success factors for intangible service products and tangible products are similar or markedly different (compare Cooper and de Brentani, 1991 with Atuahene-Gima, 1996). To avoid a potential confounding of success factors, this paper departs from the Johne and Storey (1998) definition and treats NSD and NPD as two independent fields of enquiry rather that NSD as a subset of NPD. In other words, a product is to be understood by its narrower definition as a tangible good, rather than an intangible service and studies with such foci (e.g. Pinto and Pinto, 1990) are excluded.

Meyer and Roberts (1984) go further to define a firm's "product" by stating:

> "*The sample firm had to make each "product" with its own resources, either in part or in whole, and commercialize the product under its own name at some point.*" p.813.

This definition is probably more restrictive than most of the implicit definitions of product used by all other studies that are reviewed in the paper. For example, why should the product have to be commercialised under the firm's name in order to be called a product? For this reason, the definition is left implicit as per the general consensus regarding a tangible product.

Development

Of the 38 studies reported in the body of this paper, there is widespread, if not unanimous, explicit consensus that a firm's capacity to develop and launch successful new products is crucial to its long-term survival (e.g. Thieme et al., 2003; Zirger and Maidique, 1990). With such a premise, which has been empirically validated (e.g. Griffin, 1997) offering researchers surety in the value of their endeavours, it is noteworthy that only one (Zirger and Maidique, 1990 are the exceptions) of the 38 studies actually explicitly state what they mean by development.

Development has been examined at a general programme level (e.g. Griffin, 1997), the individual project level (e.g. Cooper, 1979; Song and Parry, 1997a) and at the level of specific activities within the project (e.g. product launch: Di Benedetto, 1999; Langerak et al., 2004). Notwithstanding this, there does appear to be consensus that "development" comprises the managerial assumptions, activities and objectives pertaining to the period from ideation to launch of a tangible market offering irrespective of the unit of analysis.

This paper does not discriminate between studies with different units of analysis, because they are essentially studying the same phenomenon, but with different degrees of abstraction. Excluded however are studies that have one component of the development process as the dependent variable. For example Cohen and Levinthal (1989) focus on successful organisational learning and NPD R&D, and Gerwin and Moffat (1997) link team autonomy and NPD team performance. But because they do not try to establish a link between successful organisational learning in NPD and NPD success/failure, they are excluded.

New

"New", or "newness" has been the subject of great focus, but again few of the 38 studies define or distinguish between the types of newness in their definition of NPD (Shenar et al. (2002) is an exception). This is perhaps surprising as varying degrees of newness probably impact management and associated success factors (Ernst,

2002) and the burgeoning research effort in contingent factors for distinctive types of newness or innovation. Nevertheless, consensus in understanding is apparent, and as such the term will remain unrefined during this paper. (For further reading on definitions of newness, especially in the framework of innovation, see Henderson and Clark, 1990 or Garcia and Calantone, 2002).

Success and failure
How to measure a project's "success" remains an unresolved issue (Shenar et al., 2002). This is exemplified by Griffin and Page (1993, 1996) who have identified over 75 separate measures of success used by researchers and managers; and Story et al. (2001) who see little consensus between researchers' measurements. Numerous authors have proposed sets of success metrics (e.g. Cooper and Kleinschmidt, 1987; Pinto and Mantel, 1990), yet there is no commonly accepted framework for success or failure adopted by the studies in this paper.

With this lack of common ground, the studies appear to be countenancing an implicit understanding that success is success however it is measured and that success factors that negate failure are imperative for success. It is therefore difficult to discriminate between studies on the basis of their use of quality success and failure metrics. Instead, only studies that explicitly report the failure/success measures they use are included. Furthermore, the studies (unlike: Asterbro, 2003) must include at least an objective or subjective commercial failure/success measurement. (For further reading on success measures, see Griffin and Page, 1996 or Hultink and Robben, 1995).

Success factors
The review contains only those studies that have sought to elicit, confirm or explain the relationship(s) between managerially actionable factors and NPD success or failure. Studies, such as Sun and Wing (2005), which merely ask respondents to state their perceived success factors are not included, as their methodology implies that they are measuring believed factors rather than actual factors. Similarly, Balachandra et al. (1996) is not included (although it has been included previously published reviews e.g. Ernst, 2002) because it reports on what managers believe to constitute success and how it is communicated in the organisation.

As to what actually constitutes a success factor is again a matter of practicality. Cooper (1979a) suggests that factors can be seen as those elements of a business and are either controllable by management or purely the subject of external influence. Researchers have followed this pragmatic dichotomy and have preferred to refine the categorisation rather than seeking to further define what a success factor is. For this reason this paper adopts the pragmatic approach, but restricts the focus to actionable (controllable) factors.

2.3 Methodological boundaries
Empiricism
This review only contains studies that empirically investigated the relationship between success factors and NPD outcomes. This is necessary because the review is driven by scientific standards. By only reporting empirical work, the large body of reflective "lessons from experience" research with scant scientific method are excluded. Also excluded is the popular type of research where managers are asked to list or agree/disagree with success factors (e.g. Calantone et al., 1995), the underlying basis of which also has little scientific basis.

Sampling
The minimum sample size required for the studies to be included is ($n \geq 50$). This figure is perhaps rather arbitrary given that the different studies vary between mono and multi-industry foci, mono and multi-national foci, as well as between the project and programme levels of focus. Nevertheless 50 is a practical number that makes a trade-off between including all noteworthy studies and excluding those of inferior scientific quality.

This criterion necessitates the exclusion of some genuinely good quality case study research (e.g. Jensen and Harmsen, 2001; Story et al., 2001), and non-empirical theory-building papers (e.g. Brown and Eisenhardt, 1995). This is justified in that these papers serve mostly to organise success factors rather than elicit them, and their findings await validation in larger scale studies in accordance with standard scientific method.

Reporting
The minimum sample size criterion automatically excludes much of the research with statistically weaker methodologies. Furthermore, to avoid undiscriminating "laundry-list" research, studies are further limited to those where both statistical validity and reliability are reported using statistics common to social science research (Black, 1999).

2.4 Sample boundaries

Temporal scope

Jensen and Harmsen (2001) observe that NPD success factor research can be traced back to the mid-1950s, and Ernst (2002) and Griffin (1997) observe that such research dates back 30 years. In either case, the earliest well-known study is Project SAPPHO (see Rothwell, 1974). Despite these early beginnings, this review only includes studies published since 1980; the following major studies are therefore excluded: Chakrabarti, 1974; Gerstenfeld, 1976; Rothwell, 1974; Rubenstein, 1976, Utterback, 1976; Souder and Chakrabarti, 1978. They are excluded because much of this early literature is scarce and second-degree reporting of the results is inadequate.

Their exclusion does not impair the results of the survey or undermine the state of current NPD understanding. Moreover it may improve them, as it is questionable whether the conclusions of such studies are still valid after a quarter of a century. In any case, assuming that they are still valid, the copious ensuing body of post-1980 research covers, refines and updates the early findings more than adequately.

Geographical scope

NPD success factors research, which has its origins mostly in the USA, Canada, the UK and Japan has, over time, been extended to include settings from many developed nations with a large NPD base. Examples include: Balachandra and Brockhoff (1995): Germany; Bastic (2004): Slovenia; Huang et al. (2002): Australia; Mishra et al. (1996): South Korea; Ong and Chng (2003): Singapore; Parry and Song (1994): China; Sanchez and Elola (1991): Spain.

The geographical scope of studies included in the review is not limited. This is because the review it seeks sets of applicable criteria with overlap, rather than a single set of universally applicable NPD success factors. This is in line with the numerous calls for NPD research to move from a universalist to contingent paradigm (e.g. Mishra et al., 1996; Shenar et al., 2002).

Industrial and organisational scope

Certain studies have chosen to focus on particular industries (e.g. Cooper, 1995; Cooper and Kleinschmidt, 1995b; Zirger and Maidique, 1990). This paper sets no limit to industry types for the aforementioned "contingent paradigm" reasons.

Whereas NPD was traditionally seen purely as an organic activity for a firm (Rothwell, 1994), changing business practices have increased inorganic NPD through partnerships, alliances and joint ventures (Johne and Storey, 1998). NPD researchers have examined the success factors in these situations (e.g. Ebadi and Utterback, 1984; Gerwin and Meister, 2002). But because such forms of organisation bring with them an extra set of conditions and operating principles (Johne and Story, 2002), which impact greatly on generic NPD success factors, they are excluded from the review.

Table 2 summarises the criteria which shape this review.

Table 2: Criteria for study inclusion

Criterion	**Definition**
Focus of study	New – Implicit definition, unrefined Product – Tangible only as per common implicit definition Development – Implicit definition of ideation to market Success / failure – only studies that explicitly report the failure/success measures they use are included. Furthermore, the studies must include at least an objective or subjective commercial/financial failure/success measurement.
Publication venue	Refereed, scientific journal
Unit of analysis	Individual project or programme Intra-firm (organic) NPD, no inter-firm (alliances, JVs etc) Success factors must be actionable, although environmental factors may be commented
Time and place	Any geographic region, industry and type of firm 1980 and later
Data	Empirical

Table 2: Criteria for study inclusion

	Sample size $n \geq 50$
Statistics reporting	Reliability statistics and general method must be evident. Reliability $P \geq 0.01$, but up to $P \geq 0.05$ on occasion

3. Literature Review

3.1 Review structure

Appendix A summarises all studies included in the paper. For details of definitions, samples, methods and results the reader should refer to the appendix in conjunction with this section.

Existing frameworks

Asterbro (2003) notes, there is no confirmed theoretical model for the antecedents of NPD success; the review therefore needs an alternative structure. Chronological presentation does not make sense, as studies show only limited evolution in methods and findings over the 25-year period (Ernst, 2002). Greater sense is to be had by either division of success factors by NPD phase, functional category or similarity of activity groups.

Cooper, 1979 suggests dividing factors into controllable and environmental. As the division between these categories is being used to define the scope of the review, it is not appropriate for structure. Montoya-Weiss and Calantone (1994) suggest groups of: (1) factors that lead to success, (2) factors that lead to failure, (3) factors that distinguish between success and failure. Given that many of the factors will fall into all three categories, this too is inappropriate.

Seeking a wider review, Brown and Eisenhardt (1995) categorise NPD activities into three paradigms: (1) rational plan, (2) communication web, (3) problem solving. The result is broad, but rational plan far outweighs the other two categories, which are more or less subsumed by it. Operating largely within the rational plan paradigm, Shenar et al. (2002) group SFs into five groups: (1) idea origination and project milestones, (2) planning and control, (3) policy and design considerations, (4) organisational factors, (5) documentation, reporting and management control. Although useful, this framework is rather vague and mixes dimensions of greatly different abstraction. Consider for example the difference between the scope and vagueness of "organisational factors" or "policy and design considerations" and the precision of "documentation, reporting and management control".

Cooper and Kleinschmidt's (1995) five dimensions: (1) process, (2) organisation, (3) strategy, (4) culture, (5) commitment, are an improvement on this approach, but are themselves vague. More confounding is the "commitment" dimension, which is not clearly separable from the other dimensions. Management exhibit commitment through elements such as the role given to NPD in the organisation's strategy and resource allocation, which could both be strategy elements. Exhibiting commitment via empowerment is a cultural factor and adequate reward systems is an organisational factor. Unless management commitment is limited to personal technical and time commitment, it is confounded. And once limited to such an extent it contains insufficient descriptive power as a category.

In a more sophisticated contingent approach, Balachandra and Friar (1997) suggests division of studies' foci, rather than success factors, on the three dimensions of technology (low/high), innovation (incremental/radical) and market (new/existing). Such contingent frameworks are the logical conclusion of NPD research (Droge and Calantone, 1996) and will increasingly serve to guide future research.

Developed framework

The structure of this review takes the contingency requirement into account (as called for by Story et al. 2001 etc), but employs it as a moderating rather than structuring element. It would be inappropriate to develop a purely contingent framework for this retrospective review of a body of research, which by and large does not take contingent factors into account. The framework (see Figure 1) suggests that combinations of success factors within the managerial *frame of control*, when put in the context of the *moderating* (environmental and market) *context*, will lead to different degrees of *NPD performance drivers* (e.g. those factors that are thought to lead to NPD performance: innovation advantage, product superiority, competitive advantage).

The notion of *NPD performance drivers* raises an interesting issue. Such factors have often been identified by research (e.g. Baker et al., 1984) and listed alongside regular actionable success factors for NPD performance. This is inconsistent as they are not actionable and are in most cases simply truisms. For example, what is the real difference between innovation advantage and successful new product performance? Practically, they are one concept with two names. The only way that such factors could be included within the frame of control is perhaps as management goals in the planning category, or criteria at decision gates. But this is not how researchers intended them. Therefore, they are not included in the review as they are not in essence what they portray themselves to be: actionable factors for NPD success.

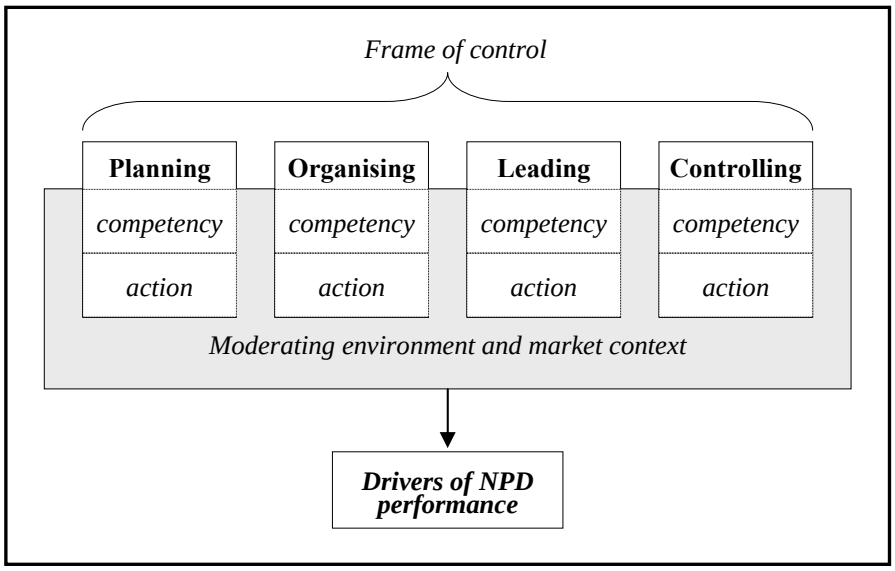

Figure 1: Organising framework

The *frame of control* organises success factors according to the commonly-applied management activity constructs of *planning, leading, organising* and *control* (see for example Daft and Marcic, 2004). These have the advantage over limitations of traditional division by function (Krishnan and Ulrich, 2001) and the other reviewed organising frameworks of less overlap and more consistent abstraction and scope.

Many studies list general functional competencies and specific decision outcomes as comparable success factors (e.g. Bastic 2004; Souder et al. 1997). Apart from the managerial difficulty in putting a recommendation such as "improve marketing competency" in place, juxtaposing concepts of entirely different levels of abstraction, which may be unavoidable when researching different products and industries (Krishnan and Ulrich, 2001), can lead to confounded results and skew comparative assessment of studies. For this reason, each management activity is refined into a dichotomy of *competency* and *decision*. *Competency* contains success factors reported by studies, which refer to general functional competencies (e.g. Jensen and Harmsen, 2001), whereas *action* includes only recommended activities in the NPD process (e.g. early product definition). The demarcation between a *competency* and *action* is not entirely impervious. For example, a good decision-state may be the result of *competency*. And the broader the scope of the *action*, the closer it comes to being considered a *competency*.

The framework makes no claim for capturing or even trying to explain the relationship between the success factors in the *frame of control* and success/failure. Although this is an important area of work in its own right, it is not within the remit of this paper (the interested reader might see Calantone et al., 1996; Langerak et al., 2004; Thieme et al. 2003 for this). Moreover, the framework has an organising, rather than explicative ontology. Although not perfectly distinct, descriptive or all-encompassing, this framework is considered to be useful in organising the studies reported, minimising inconsistencies in the abstraction of concepts and providing the reader with a clear means of comprehension, interpretation and comparison of the studies' results.

3.2 Planning success factors

"Planning" refers to the managerial activities of selecting goals and choosing how to achieve them (Daft and Marcic, 2004). In the NPD context, this often reflects the strategic choice of types of products to develop in relation to their markets, internal competencies as well as the choice of resource allocation to functional strategies.

Table 3: "Planning" success factors reported in studies

Study	Success Factors (Operator indicates direction of impact and strength from ++ to --. *a*/*c* indicates activity or competence)
Atuahene-Gima (1996)	• HR strategy (++)*a* • technology synergy (+)*a*

Table 3: "Planning" success factors reported in studies

	• marketing synergy (+)*a* • market competition intensity (-)*a*
Bastic (2004)	• marketing synergy (+)*a* • market potential (+)*a* • technical synergy (+)*a*
Cooper (1979a, 1979b, 1980)	• technical and production synergy and proficiency (++)*ac* • newness to the firm (--)*a* • market competition and customer satisfaction (+)*a* • marketing and managerial synergy (+)*a*
Cooper (1984)	• technological sophistication and orientation (++)*ac* • production and technological synergy (++)*a* • product fit and focus (++)*a* • market newness (--)*a* • market potential, size and growth (++)*a*
Cooper and Kleinschmidt (1995a, 1996)	• defined NP strategy – clear well-communicated goals (++)*a* • strategic long-term focus (++)*a* • relative R&D spending (+)*a*
Cooper et al. (2004a,b,c)	• role of NPD in overall business goals (++)*a* • strategic areas defined, clear goals and long-term commitment (++)*a* • portfolio management (+)*a* • resource allocation reflects strategy and capabilities (+)*a*
Dwyer and Mellor (1993)	• technical corporate fit and focus (++)*a* • technological sophistication and orientation (++)*ac* • marketing corporate fit and focus (+)*a* • marketing orientation and domination (+)*a* • product fit (+)*a*
Griffin (1997)	• specific NPD strategies (++)*a*
Langerak et al. (2004)	• market orientation (+)*a*
Maidique and Zirger (1984)	• synergy of new product technologies and markets to firm's strengths (++)*a*
Meyer and Roberts (1986)	• strategic focus on one key technology area (++)*a* • specific growth strategies driven by combining core technology with planning of new functionalities of new non-key technology (++)*a*
Parry and Song (1994)	• newness of production process to firm (--)*a* • competitive intensity (-)*a* • market size and potential (+)*a* • fit with company skills (+)*a*
Song and Parry (1997a)	• technical synergy (+)*a* • marketing synergy (+)*a*
Song and Parry (1997b)	• fit with R&D and marketing (++)*a*

Table 3: "Planning" success factors reported in studies

Thamhain (1990)	• goal and priority setting (+)*a*
Thieme et al. (2003)	• planning proficiency (+)*c*
Zirger and Maidique (1990)	• product synergy with firm resources (++)*a* • market competitiveness (-)*a* • size and growth of market (+)*a*

The planning success factors contained in 17 studies are listed in Table 3. They suggest that organisations must select the right projects, in coherence with internal capabilities and market conditions to improve NPD performance. Furthermore the studies suggest that they must implement such a selection policy in an effective manner and as part of an overall organisational commitment to NPD.

Selecting the right projects
Projects that are synergetic with the organisation's past experience (e.g. Parry and Song, 1994) and current competencies and resources are more likely to lead to success. Production/technology/R&D synergy is the most commonly cited area for fit with 10 studies positing a significant positive relationship (e.g. Atuahene-Gima, 1996; Bastic, 2004). Of lesser, but still relatively high importance, is marketing synergy (5 studies), which highlights long-standing importance of having a market-orientation culture in the organisation (Dwyer and Mellor 1983; Langerak et al., 2004).

Studies also widely suggest that projects should be selected according to the potential of the target market (e.g. Bastic, 2004; Cooper, 1984). Constituent elements of the market potential construct reported include market competition (i.e. Bastic, 2004; Cooper, 1979a, 1979b, 1980; Parry and Song, 1994; Zirger and Maidique, 1990), market growth (i.e. Cooper, 1984; Parry and Song, 1994; Zirger and Maidique, 1990, market size (i.e. Parry and Song, 1994; Zirger and Maidique, 1990). When taken as a whole, it is clear that the studies report that market attractiveness will have a large impact on new products' commercial performance.

Strategic commitment to New Product Development
The studies also consistently relate the need for a clear NPD strategy (e.g. Cooper et al., 2004a,b,c; Griffin, 1997). Goal setting and project prioritisation are important (Thamhain, 1990) as well as the proficiency of the planning process itself (Thieme et al., 2003). Such a strategy should evince a long-term focus and commitment and be clearly communicated (Cooper and Kleinschmidt, 1995a, 1996) throughout the organisation.

Strategic-level considerations also suggest that organisations should be market-oriented (Dwyer and Mellor 1993; Langerak et al., 2004), although Cooper, 1984 and Dwyer and Mellor (1993) themselves suggest that technological orientation to be more appropriate.

3.3 Organising success factors
"Organising" refers to the managerial activities of dividing responsibilities throughout the organisation for task achievement (Daft and Marcic, 2004). In the NPD context, this reflects the manner in which the NPD process is organised and managed.

Table 4: "Organising" success factors reported in studies

Study	**Success Factors (Operator indicates direction of impact and strength from ++ to --. *a*/*c* indicates activity or competence)**
Atuahene-Gima (1996)	• predevelopment activity (+)*a* • proficiency of launch (+)*c*
Baker et al. (1986)	• identification of business need (++)*a* • results transferred to internal user (+)*a* • internal user can produce, market, sell the product (+)*a*
Balachandra and Brockhoff (1995)	• pressure on project leader (-)*a* • project leader adaptability (+)*c* • project champion (+)*a*

Table 4: "Organising" success factors reported in studies

Balbontin et al. (1999)	• marketing and design proficiency (++)*c* • accurate market forecasts and customer requirements (+)*a* • technical and commercial information sharing (++)*a* • proficient project management (+)*c* • adequate market research skills (++)*c* • adequate sales and marketing skills (+)*c*
Barczak (1995)	• R&D team (++)*a* • product marketing managers (+)*a* • project teams (+)*a* • generating ideas (+)*a*
Bastic (2004)	• market research proficiency and marketing information (++)*c* • launch proficiency (++)*c* • pre-test proficiency (+)*c* • technical activity proficiency and technological information (+)*c*
Calantone and Di Benedetto (1988)	• marketing resources and skills (++)*c* • competitive and market intelligence (++)*a* • technical activities (++)*a*
Calantone et al. (1996)	• marketing resources and skills (++)*c* → marketing proficiency • technical resources and skills (++)*c* → technical proficiency • competitive intelligence (++)*a*
Cooper (1979a, 1979b, 1980)	• technical and production proficiency (++)*c* • marketing knowledge and proficiency (++)*c*
Cooper (1984)	• strong marketing programme (++)*c*
Cooper (1988, 1994)	• market assessment (++)*a* • technical assessment (++)*a* • detailed market study (++)*a* • business financial analysis (++)*a* • in-house testing (+)*a* • market trial (+)*a* • market launch (+)*a*
Cooper (1994)	• quality of pre-development activities (++)*c* • marketing proficiency and quality (++)*c* • x-functional organisation (+)*a* • early product definition (+)*a*
Cooper and Kleinschmidt (1995a, 1996)	• high-quality process – steps, activities and decision-points to move from idea to launch defined NP strategy (++)*a*
Cooper et al. (2004a,b,c)	• team stays on project for whole process (++)*a* • members clearly assigned (+)*a*
Di Benedetto (1999)	• x-functional teams make marketing/sales decisions (++)*a* • advertising and promotion capability is at least adequate (++)*c* • marketing research capability is at least adequate (+)*c* • launching into marketplace (++)*a*

Table 4: "Organising" success factors reported in studies

	• outsourcing specialist work (++)*a* • test marketing (+)*a*
Dwyer and Mellor (1991a)	• preliminary market and technical assessment (++)*a* • trial production (+)*a* • trial launch (+)*a*
Dwyer and Mellor (1991b)	• preliminary market and technical assessment (++)*a* • production start-up (+)*a* • pre-commercialisation business analysis (+)*a* • trial production and launch (+)*a*
Hauschildt and Kirchmann (2001)	• troika of champions (++)*a*
Huang et al. (2002)	• market testing (++)*a* • financial analysis (+)*a* • commercialisation (+)*a*
Langerak et al. (2004)	• proficiency in launch activities (++)*c*
Larson and Gobeli (1988)	• use of balanced matrix and project matrix (++)*a* • use of project team (+)*a*
Maidique and Zirger (1984)	• market knowledge from customer interaction (++)*c* • planning of NP process (++)*a* • co-ordination of NP process (+)*a* • sales and marketing concentration (+)*a*
Mishra et al. (1996)	• marketplace intelligence (inc. knew: user needs, wants, price sensitivity, competitor products, strategies) (++)*a* • launch effort (inc. focussed sales effort, adequate production volume, strong sales effort) (+)*a*
Parry and Song (1994)	• proficiency of development activity (++)*c* • information acquired (+)*a* • proficiency of launch (+)*c*
Shenar et al. (2002)	• High-uncertainty projects: design considerations (++)*a*, customer participation (+)*a* • Low-uncertainty projects: formal selection of contractor (++)*a*, early design freeze (+)*a* • Broad-scope projects: formal bid preparation (++)*a*, formal contracts (+)*a*, formalised documentation (+)*a*
Song and Parry (1997a)	• x-functional integration (++)*a* • competitive and market intelligence (++)*a* • technical and marketing proficiency (+)*c*
Song and Parry (1997b)	• x-functional integration (++)*a* • business and market opportunity analysis (++)*a*
Souder et al. (1997)	• marketing proficiency (++)*c* • technical skills (++)*c*
Souder and Song	• decentralisation (+)*a*

Table 4: "Organising" success factors reported in studies

(1998)	• sales and marketing expertise (+)*c* • technical expertise (+)*c* • project manager competence (+)*c*
Thamhain (1990)	• team autonomy (++)*a* • experienced and qualified team (++)*c*
Thieme et al. (2003)	• participative management style (++)*a* • project manager skills (++)*c* • x-functional integration (++)*a*
Zirger and Maidique (1990)	• quality of R&D organisation (++)*c* • marketing and manufacturing competence (+)*c*

The organising success factors contained in 33 studies are listed in Table 4. This area is the most popular of the four contained by the structuring framework and contains three types of success factor: 1) pre-development activities and competency, 2) marketing activities and competency, 3) organisational issues.

Pre-development activities
Five studies stressed the importance of pre-development activities (Atuahene-Gima, 1996; Bastic, 2004, Cooper, 1994, Dwyer and Mellor, 1991a,b). Dwyer and Mellor (1991a,b) suggested the benefits of early stage business case and market need analysis. They balanced this commercial focus with the need for an early-stage complimentary technical focus. Cooper (1994) supported this with the observation that the an early design freeze would also lead to improved NPD performance.

Marketing activities and competency
Twenty-two studies found that at least one element of a marketing/sales competency leads to improved NPD performance. General sales and marketing skills are also important (Balbontin, 1999; Cooper 1979a, 1979b, 1980; Cooper, 1984; Cooper 1994; Maidique and Zirger, 1984; Souder et al., 1997; Souder and Song, 1998), but not necessarily at an actionable level for managers. However, both Cooper (1988, 1984) and Song and Parry (1997b) recommend thorough business and financial analysis as part of the marketing activities.

A strong market research competency that might contain knowledge of the market, competitors and customers was stressed (Balbontin, 1999; Barczak, 2004; Calantone and Di Benedetto, 1988; Calantone, 1996; Di Benedetto, 1999). Balbontin, (1999) and Cooper (1988,1994) suggested that this should be made actionable through detailed market assessments and forecasts. Similarly, Calantone and Di Benedetto, 1988 and Calantone, 1996 specified that the competitive intelligence component of the market research needs to be adequate to improve NPD performance. Maidique and Zirger, 1984 and Mishra et al., 1996 both complemented the market and competitor foci with the need to understand the customer as key factor for NPD success.

The third area of recommendation for proficiency in the marketing competency is that of new product launch. Increased organisational effort and resource allocation to the product launch improves the likelihood of success (Atuahene-Gima, 1996; Bastic, 2004; Cooper, 1988,1994; Di Benedetto, 1999; Langerak et al., 2004; Parry and Song, 1994). Furthermore, the importance of using a trial launch and significant test marketing was also found to be an important antecedent of success (Cooper, 1988,1994; Di Benedetto, 1999; Dwyer and Mellor, 1991a,b; Huang et al., 2002).

Organisational issues
Fourteen studies identified organisational factors that contribute to NPD success. The majority of these relate to the personnel involved in the NPD process and the minority relate to the process itself.

The use of project champions is critical for NPD success (Balachandra and Brockhoff, 1995; Hauschildt and Kirchmann, 2001; Larson and Gobeli, 1988). Furthermore the competencies of the individual for that position are important (Balachandra and Brockhoff, 1995; Souder and Song, 1998; Thieme et al., 2003). However, the use of teams has also repeatedly been found to be an important driver of success (Barczak, 1995; Cooper et al., 2004a,b,c; Thamhain, 1990), with either cross-functional composition or integration of functions of paramount importance (Cooper, 1994; Di Benedetto, 1999; Song and Parry, 1997a,b; Thieme, et al., 2003). Furthermore, the team should be have the necessary experience and competencies (Thamhain, 1990), be clearly assigned the

project for it entire lifespan (Cooper et al., 2004) and have the necessary authority delegated to it (Souder and Song 1998; Thamhain, 1990).

The NPD process has received less focus. However, the need for a planned and well co-ordinated process is apparent (Cooper and Kleinschmidt, 1995a,1996; Maidique and Zirger, 1984; Zirger and Maidique, 1990). Furthermore, project management competence is thought to be important (Balbontin et al., 1994).

3.4 Leading success factors

"Leading" refers to the use of management's formal and informal influence to lead and motivate the organisation (Daft and Marcic, 2004). In the NPD context, this is reflected in the allocation of resources to developing a given product and how management personally support the process.

Table 5: "Leading" success factors reported in studies

Study	Success Factors (Operator indicates direction of impact and strength from ++ to --. *a*/*c* indicates activity or competence)
Atuahene-Gima (1996)	• managerial support and teamwork (++)*a*
Baker et al. (1986)	• general management involvement (++)*a*
Balachandra (1984)	• lack of personnel support (--)*a*
Balachandra and Brockhoff (1995)	• top management support (++)*a*
Bastic (2004)	• management and financial support (+)*a*
Cooper (1979a, 1979b, 1980)	• size of investment (+)*a*
Cooper (1994)	• leadership, accountability (+)*a*
Cooper and Kleinschmidt (1995a, 1996)	• strategic long-term focus (++)*a* • adequate resources (+)*a* • senior management commitment through resource allocation (+)*a*
Cooper et al. (2004a,b,c)	• supportive climate (++)*a* • people and teams rewarded (++)*a* • resources available (++)*a* • skunkworks and creative time-off (+)*a* • new ideas formally encouraged (+)*a* • resource allocation (all-round) (+)*a*
Maidique and Zirger (1984)	• management support (++)*a*
Song and Parry (1997b)	• internal commitment (++)*a*
Souder and Song (1998)	• top management involvement (+)*a*
Thamhain (1990)	• management involvement (+)*a* • management interested (+)*a*
Thieme et al. (2003)	• senior management support (++)*a*
Zirger and Maidique	• management support (+)*a*

Table 5: "Leading" success factors reported in studies

(1990)

Fifteen studies converge on the idea that the support of top management is vital for NPD success. More specifically, Cooper (1994) suggests that top management needs to provide leadership and promote accountability in the process. Support actions can also include sufficient financial or resource investment (Cooper, 1979a,c, 1980; Bastic, 2004; Cooper and Kleinschmidt, 1995a, 1996; Cooper et al., 2004a,b,c), or providing a supportive climate through rewards and encouraging new ides (Cooper et al., 2004a,b,c) to promote internal support (Balachandra, 1984; Song and Parry, 1997b).

3.5 Controlling success factors

"Controlling" refers to management's responsibility for tracking organisational activities and identifying areas where corrective action is warranted (Daft and Marcic, 2004). In the NPD context, this reflects the gates, budgeting and portfolio decisions that control the NPD process.

Table 6: "Controlling" success factors reported in studies

Study	Success Factors (Operator indicates direction of impact and strength from ++ to --. *a*/*c* indicates activity or competence)
Balachandra and Brockhoff (1995)	• deviations in cost schedule (--)*a* • deviation in time schedule (-)*a*
Bastic (2004)	• concept development and evaluation (+)*a*
Cooper (1988, 1994)	• initial screening (++)*a*
Cooper et al. (2004a,b,c)	• documented, visible with strict gates (++)*a*
Di Benedetto (1999)	• studying customer feedback (+)*a*
Dwyer and Mellor (1991a)	• initial screening (++)*a* • preliminary market and technical assessment (++)*a*
Dwyer and Mellor (1991b)	• initial screening (++)*a* • preliminary market and technical assessment (++)*a*
Griffin (1997)	• use of stage-gate processes with sophisticated gates specific (++)*a* • set clear targets (+)*a* • measure performance regularly (+)*a*
Huang et al. (2002)	• initial screening (++)*a*
Shenar et al. (2002)	• high-uncertainty projects: milestones (++)*a* • low-uncertainty projects: budget monitoring (++)*a*, statistical quality control (+)*a* • broad-scope projects: formal contracts, formalised documentation (+)*a*

The least focused upon of the four categories, controlling factors are action-oriented. Control at sequential stages in the process have been found to be important: preliminary market and technical assessment (Dwyer and Mellor, 1991a,b); initial screening (Cooper, 1988,1994; Dwyer and Mellor, 1991a,b; Huang et al., 2002) and concept evaluation (Bastic, 2004). These findings are complimented with Cooper et al.'s (2004) and Griffin's (1997) recommendation that projects use strict gates with strict targets and regular measurement. Deviations in cost or time are indicators of a failing new product (Balachandra and Brockhoff, 1995), which may become apparent with the use of stringent quality controls and milestones (Shenar et al., 2002).

4. Conclusion

This paper provided a summary review studies that have sought to elicit, confirm or explain the relationship(s) between managerially actionable factors and NPD success or failure in the single firm. Success or failure was accepted as per the individual study's definition so long as there was a link to commercial success. Because of the size of the field of literature (e.g. Song and Montoya-Weiss, 2001) and the lack of consistent constructs, focus and definitions (e.g. Kessler and Chakrabarti, 1996) and poor research methods (e.g. Balachandra and Friar, 1997), the review was focussed on empirical studies that, having been published since 1980, contain adequate scientific standards.

This paper found, in coherence with (Brown and Eisenhardt, 1995, Montoya-Weiss and Calantone, 1994), that the studies have consistently produced similar list of criteria. However, this may well be because researchers are simply building upon previous research through replication studies and not using exploratory method to uncover new ones. An alternative explanation is that many of the success factors are descriptive rather than actionable and general in nature. This would certainly explain why NPD managers report that such findings are difficult to implement (Biemans and Harmsen, 1995) and why managers are apparently making the same mistakes as always (Cooper, 1998).

The most important "leading" success factors are top management support exhibited through resource allocation and personal investment. Being aware and communicating that NPD is of strategic importance was a key factor on the "planning" dimension. However, unless the right projects are picked to start with, in alignment with the organisation's experience, competencies and overall strategy the proportion of successes is greatly diminished. The "organisational" area emphasised the importance of cross functional teams and committed, competent project champions. Furthermore the need for a strong marketing competency, especially in relation to the product launch and understanding the market, customers and competitors was repeatedly found. Lastly, and of less emphasis, was that the entire NPD process should be well-planned and contain regular strict project gates in order to maintain adequate "control".

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Appendix A

This appendix summarises the studies included in this paper in alphabetical order.

- **Sample size (n)** is as quoted by author in terms of responses. As one respondent often makes more than one response, this can at times be misleading, but is in accordance with common NPD research practice.
- **Definitions** of terms *new, product, development, success* when included by authors.
- **Method** gives an overview of the data collection and analysis method employed.
- **Key findings** indicate the main conclusions pertaining to NPD success factors.
- ~~Strike-through~~ indicates a non-actionable success factor reported.
- *Italic* indicates NPD performance driver rather than actionable factor.
- (-) indicates negative relationship, where reported by author.

Atuahene-Gima (1996) (JPIM) – n=158, Australia, broad range of manufacturing firms

• Definitions	NPD is a strategic response that aligns the organisation with internal and external environments. Success is a 12-item construct.
• Method	Mail questionnaire to marketing managers, SF and success rating from recall. Factor analysis and LISREL.
• Key findings	(1) *innovation advantage*, (2) managerial support and teamwork, (3) ~~firm size~~, (4) HR strategy, (5) technology synergy, (6) marketing synergy, (7) predevelopment activity, (8) proficiency of launch, (9) *newness of innovation*, (10) market competition intensity(-).

Baker et al. (1986) (RM) – 211, Geography, industry

• Definitions	18 Project, managerial, organisational, environmental conditions lead to NPD success.
• Method	Mail questionnaires. Positive, negative instance.
• Key findings	(1) experience, (2) general management involvement. R&D projects: (1) identification of business need, (2) appropriate suitability, (3) results transferred to internal user, (4) internal user can produce, market, sell the product.

Balachandra (1984) (JPIM) – n=114, Geography, industry

• Definitions	12
• Method	Positive, negative instance.
• Key findings	Factors where negative change induce termination: (1) subjective probability of technical success, (2) ~~raw material availability~~, (3) ~~government regulations~~. Factors where negative change might induce termination: (1) probability of commercial success, (2) personnel support, (3) technological problems.

Balachandra and Brockhoff (1995) (RTM) – USA (n=116) mostly electrical machinery & Germany (n=155) no focus

• Definitions	R&D project is equated with NPD. Success is on a three-point scale: successful, terminated by management and failed for economic reasons.
• Method	Mail questionnaires to managers. SF rating at start, middle, end of project. Stepwise discriminant analysis.
• Key findings	USA: (1) deviations in cost schedule(-), (2) project champion, (3) deviation in time schedule(-), (4) change in top management support, (5) pressure on project leader(-). Germany: (1) time of anticipated competition, (2) change in top management support, (3) ~~Chance event~~(-), (4) project leader adaptability, (5) project champion.

Balbontin et al. (1999) (JPIM) – n=208, Geography, industry

• Definitions	1
• Method	Positive, negative instance.
• Key findings	marketing and design proficiency accurate market forecasts and customer requirements -- technical and commercial information sharing proficient project manager -- adequate market research skills adequate sales and marketing skills

Barczak (1995) (JPIM) – n=140, USA, telecoms industry

• Definitions	NPD strategy is time-based. NPD structure is a choice between organic/non-organic and internal organisation.
• Method	Mail questionnaire to NPD managers. Ratings on a six-point scale for organisation (six types), and activities used (10 types). Success contains two financial items and one subjective. Simple statistics and Chi2.
• Key findings	Performance discriminators: Organisation: use of (1) R&D teams, (2) product marketing managers, (3) project teams. Activities: (1) generating ideas, (2) screening ideas.

Bastic (2004) (EJIM) – n=155, Slovenia, wide variety of non-service companies developing new products

• Definitions	Implicitly as per Cooper 1979.
• Method	Mail questionnaire to managers based on Cooper (1979a). T-tests, correlations, factor analysis, discriminant analysis.
• Key findings	Important individual factors: (1) market research proficiency, (2) marketing information, (3) launch proficiency, (4) *product advantage*, (5) marketing synergy, (6) pre-test proficiency, (7) technical activity proficiency, (8) technological information, (9) market potential, (10) technical synergy, (11) concept development and evaluation, (12) management and financial support, (13) pre-development planning, (14) market competitiveness. Factor analysis reduction: (1) marketing activities, (2) technical factors, (3) development, (4) *new product advantage*, (5) marketing competitiveness, (6) marketing pre-test proficiency.

Calantone and Di Benedetto (1988) (JPIM) – n=189, Geography, manufacturing industry

• Definitions	4 Success equates to commercial success.
• Method	Positive and negative instance.
• Key findings	Marketing activities (marketing resources and skills; competitive and market intelligence) Technical activities

Calantone et al. (1996) (MarSci) – n(Canada)=195, n(USA)=142, n(China)=147, n(∑)= 384), Canada, USA, China, Mixed industries. (NB replication study that make use of Cooper (1979a) for Canada data)

• Definitions	NPD process consists of marketing and technical activities. Structural model of manageable factors only.
• Method	Mail questionnaires. Structural equation modelling.

- Key findings <u>NPD causal relationships confirmed:</u>
  - marketing resources and skills lead to competitive intelligence
  - marketing resources and skills lead to marketing proficiency
  - technical resources and skills lead to technical proficiency
  - competitive intelligence leads to marketing proficiency
  - competitive intelligence leads to technical proficiency
  - competitive intelligence leads to product quality
  - technical proficiency leads to product quality (China and USA not significant)
  - marketing proficiency leads to NP success
  - technical proficiency leads to NP success
  - product quality leads to NP success (USA not significant).

Cooper (1979a, 1979b, 1980) (IMM, JoM, EJM) – n=195, Ontario and Quebec Provinces in Canada, no industry focus

- Definitions SFs to distinguish winners from losers as per previous research. Success equates to perceived financial success.
- Method Mail questionnaire. Senior managers or NPD officers evaluating recent positive and negative projects on 77 items each with an 11-point scale. Factor, discriminant analysis.
- Key findings <u>18 factors</u>: (1) technical and production synergy and proficiency, (2) marketing knowledge and proficiency, (3) newness to the firm, (4) *product uniqueness/superiority*, (5) market competition and customer satisfaction, (6) marketing and managerial synergy. (Other 12 factors loading < 5%).
  <u>Factors discriminating between success and failure</u>: (1) *product uniqueness/superiority* (2) marketing knowledge and proficiency, (3) technical and production synergy and proficiency, (4) market dynamism(-), (5) market need, growth and size, (6) relative price of product(-), (7) marketing and managerial synergy, (8) market competitiveness and customer satisfaction(-), (9) newness to the firm(-), (10) marketing communications and launch, (11) source of idea, size of investment.

Cooper (1984) (EJM) – n=122, Ontario and Quebec Provinces in Canada, no industry focus

- Definitions NPD strategy equates to a combination of product, market, technology and process factors.
- Method Mail questionnaire. Senior managers or NPD officers evaluating 66 items each with an 11-point scale. Factor analysis. SFs to distinguish winners from losers. Success is an eight-item construct of financial success and general NPD output measures.
- Key findings Five strategies could be identified.
  <u>19 strategy dimensions</u>: (1) technological sophistication and orientation, (2) production and technological synergy, (3) product fit and focus, (4) market newness, (5) market potential, size and growth. (Others < 4% loading).
  <u>Key discriminators</u>:
  <u>Programme</u>: market orientation and strong marketing programme, technologically sophisticated and oriented, focussed programme.
  <u>Market</u>: non-competitive, high-growth large markets, market knowledge of market needs and previous experience in market itself.
  <u>Product</u>: product synergy with existing product line, premium-priced, *product advantages – quality and superiority* that leads to customer impact and features, standard products with little customisation.

Cooper (1988, 1994) (JoMM, IMR); Kleinschmidt and Cooper (1988) (EJM) – n=203, Canada, no industry focus

- Definitions NP success is influenced by international orientation. Success equates to financial success with a six-item construct. Positive and negative projects rated on 13 activities.
- Method Questionnaire administered by interview. ANOVA.

- Key findings Discriminators between success and failure (sig. only): (1) initial screening, (2) market assessment, (3) technical assessment, (4) detailed market study, (5) business financial analysis, (6) product development, (7) in-house testing, (8) market trial, (9) market launch.

Cooper (1994) (IMR); Cooper and Kleinschmidt (1995b,c) (JoMM, IMM); – n=103, USA, Germany, UK, Canada, chemical

- Definitions Success captured by mostly financial and time measures, seven-item measure, mostly 11-point scales. NPD has 12 constructs.
- Method NPD has 12 constructs in 94 variables, all rated on 11-point scales.
- Key findings 5 clusters of performers identified
  Best discriminators of high and low performers: (1) quality of pre-development activities, (2) *superior product*, (3) marketing proficiency and quality, (4) leadership, accountability and x-functional, (5) early sharp product definition, (6) *extended-product competitive advantage*. Other 7 constructs are not important.

Cooper and Kleinschmidt (1995a, 1996) (JPIM, RTM) – n=135, USA, Canada, Germany, Denmark, no industry focus

- Definitions Five blocks of variables can lead to multidimensional NPD performance. (NB five blocks of variables translated to eight constructs)
- Method Mail questionnaire to NPD executives. Eight constructs, comprised in 48 measures (five-point scales) rated. Success is a 10-item construct (eight of these are five-point scales) mostly financial and subjective performance. Factor analysis.
- Key findings Four performance types identified, SFs that discriminate on the business unit level:
  (1) high-quality process – steps, activities and decision-points to move from idea to launch
  (2) defined NP strategy – clear well- communicated goals, strategic long-term focus
  (3) adequate resources – senior management commitment through resource allocation
  (4) relative R&D spending – relative to sales; an important lever.

Cooper et al. (2004a,b,c) (RTM) – n=105, USA, Canada, no industry focus

- Definitions 113 "prescribed practices" in 17 areas encapsulate NPD. 17 areas subdivided into 3 areas.
- Method Mail questionnaire, Success has five items: financial, meeting objectives, success rate, time to market and to time/budget. All rated on 10 point scale or %.
- Key findings Climate, senior management support and team organisation:
  - Climate: supportive climate, people and teams rewarded, resources available, skunkworks and creative time-off, new ideas formally encouraged
  - Senior management: strong commitment and empowerment, NP metrics related to their objectives, NPD process understanding/design involvement.
  - Team organisation: team stays on project for whole process, members clearly assigned, clear leader, leader responsible throughout.

  Strategy, resource allocation, portfolio management:
  - Strategy: role of NPD in overall business goals, strategic areas defined, clear goals and long-term commitment
  - Resource allocation: adequate sales force, adequate marketing resources, adequate manufacturing/operations resources
  - Portfolio management: percentage high value to business projects, type balance, resource allocation reflects strategy and capabilities, quality prioritisation

  NPD process:
  - Systematic process: documented, visible with strict gates
  - Execution: recapitulation of 2004a,b but more detailed
  - In-built best practice: recapitulation of 2004a,b but more detailed
  - Spending on early stages: not significant

Di Benedetto (1999) (JPIM) – n=183, geography unspecified (USA assumed), no specific industry

• Definitions	Focus on product launch phase of NPD. Launch is strategic and tactical decision and information gathering. Success is a four-item construct (overall profitability, profitability, market share, relative sales).
• Method	Mail questionnaire to PDMA practitioners. 46 success factors rated against recent project.
• Key findings	Strategic: (1) x-functional teams make marketing/sales decisions, (2) advertising and promotion capability is at least adequate, (3) marketing research capability is at least adequate. Tactical: (1) launching into marketplace, (2) customers see timing as excellent, (3) finalised plans for marketing. Information gathering: (1) outsourcing specialist work, (2) test marketing, (3) studying customer feedback.

Droge and Calantone (1996) (IMM) – n=142, USA, Fortune 500

• Definitions	NP performance generated by risk profile, competitive stance, structure, product profile and is contingent upon firm's industry dominance. NPD success equates to financial success (one item).
• Method	Mail questionnaire to managers. Items on 11-point scale. Structural equation, EQS.
• Key findings	Non-dominant firms: all related: risk profile, competitive stance, structure, product profile. Dominant firms: less, and NP profile much less important.

Dwyer and Mellor (1991a) (JPIM) – n=95, Australian, manufacturing industry

• Definitions	6 Success is a three-item construct (profit, sales, window of opportunity)
• Method	
• Key findings	initial screening, preliminary market and technical assessment, product development, trial production, trial launch

Dwyer and Mellor (1991b) (R&D) – n=114, Australia, UK, Belgium, industry

• Definitions	7 Success is a three-item construct (profit, sales, window of opportunity)
• Method	Mail questionnaires to managers responsible for NPD.
• Key findings	initial screening, preliminary market and technical assessment, product development, production start-up, pre-commercialisation business analysis, trial production, trial launch

Dwyer and Mellor (1993) (AusJM) – n=108, NSW, Australia, no industry focus

• Definitions	Cooper (1984) replication study.
• Method	Mail questionnaire. Knowledgeable persons evaluating 66 items each with 11-point scale. Factor analysis. SFs to distinguish winners from losers. Success is a seven-item construct of mostly financial success and other NPD output measures. Factor, discriminant analysis.
• Key findings	18 factors identified (6 > 4% exp. var.): (1) technical corporate fit and focus, (2) *product uniqueness and advantage*, (3) technological sophistication and orientation, (4) marketing corporate fit and focus, (5) marketing orientation and domination, (6) product fit.

Ebadi and Utterback (1984) (ManSci) – n=117, USA, marine resources

- Definitions: Communication focus, where communication is either personal or inter-organisational. Success is multiple source and subjective.
- Method: Mail questionnaire to grant managers, directors and project monitors and investigators. Ratings of communication variables, factor analysis.
- Key findings: Success is typified by (only fully-supported hypotheses reported):
  - high frequency of communication
  - project centrality in communication network
  - communication frequency > centrality > diversity (in terms of explanatory power).

Griffin (1997) (JPIM) – n=372, USA, no industry (firms that are members of PDMA, CorpTech and American Marketing Association)

- Definitions: NPD equates to strategy, process and organisation.
- Method: Mail questionnaire to unspecified individuals/positions. Success has seven items reflecting relative, market and financial performance of NPD programme, measured on nine-point scales. Respondents reply to process, strategy and organisational variables. ANOVA
- Key findings: Discriminating factors between the "best" and the "rest":
  - use of stage-gate processes with sophisticated gates
  - specific NPD strategies, especially a formal strategy step in the NPD process
  - not skipping steps in the NPD process
  - reporting structure makes no difference
  - reward to teams and champions
  - set clear targets and measure performance regularly.

Hauschildt and Kirchmann (2001) (R&DMan) – n=133, Germany, plant construction & engineering

- Definitions: Promoter or champion as extant research. Innovativeness, technical and financial success measured on single item seven-point self-reported scales. Power, process and technology promoters constitutes a "troika"
- Method: Mail questionnaire and interviews with organisationally identified "promoters". F-tests, simple statistics, which are only just acceptable.
- Key findings: Troika existence leads to commercial success.
  Technical innovation is required for commercial success.

Huang et al. (2002) (JSBM) – n=276, Australia, Chemical and machinery industries (SMEs)

- Definitions: NPD Process "includes those activities and decisions that move a product from idea to launch…and…[their] effectiveness has a significant impact on new product performance" Huang et al., (2002: p. 28), which are taken from Cooper and Kleinschmidt (1986) and Cooper (1996).
- Method: Mail questionnaire to primarily CEOs and functional managers of innovative SMEs. Self-reporting of quality and completeness of NPD activities. 17 items of success measured. t-tests, factor analysis, cluster analysis.
- Key findings: Completeness: only initial screening differentiates successful and unsuccessful projects.
  Quality: (1) market testing, (2) financial analysis, (3) commercialisation.

Langerak et al. (2004) (JPIM) – n=126, The Netherlands, mostly metal and equipment manufacture

- Definitions: Examines if market orientation of NPD (22 items) has an impact on product performance (17 items).
- Method: Mail questionnaires to managers, LISREL.

- Key findings <u>NPD causal relationships confirmed:</u>
  - market orientation leads to *product advantage*
  - market orientation leads to proficiency in launch activities
  - *product advantage* leads to new product performance
  - proficiency in launch tactics (an item in the launch activities construct) leads to new product performance
  - BUT, market orientation could not be shown to directly lead to new product performance.

Larson and Gobeli (1988) (JPIM) – n=540, Geography, industry

- Definitions: 16 Success is cost, schedule and technical performance. Organisational structure equates to: functional, functional matrix, balanced matrix, project matrix, project team.
- Method: Managers asked to rate projects on multidimensional construct. Data on type or organisational structure used, and ideal structure if project was repeated.
- Key findings: (1) balanced matrix and project matrix
  (2) project team
  (3) functional and functional matrix.

Maidique and Zirger (1984) (IEEE) – n=158, USA, industry

- Definitions: 9 Success equates to financial breakeven
- Method: positive negative instance
- Key findings: (1) market knowledge from customer interaction, (2) planning of NP process, (3) co-ordination of NP process, (4) sales and marketing concentration, (5) management support, (6) contribution margin, (7) early market entry, (8) synergy of new product technologies and markets to firm's strengths

Meyer and Roberts (1986) (ManSci) – n=79, USA, generally high-tech industry

- Definitions: Product is something made by the firm, with its own resources, in part or whole, and commercialised under its own name.
- Method: Interviews with managers of 10 firms, plotting of product newness against results. Programme-level study.
- Key findings:
  - strategic focus, especially on one key technology area
  - specific growth strategies driven by combining core technology with planning of new functionalities and new non-key technology.

Mishra et al. (1996) (JPIM) – n=288, South Korea, no focus (NB replication study that make use of Cooper (1979a) and Parry and Song (1994))

- Definitions: Implicitly follows Cooper (1979a) - environmental / controllable dichotomy.
- Method: Mail questionnaire to marketing managers. SF rating on positive and negative projects from recall.
- Key findings: (1) marketplace intelligence, (inc. knew: user needs, wants, price sensitivity, competitor products, strategies), (2) product-firm compatibility, (inc. management, marketing and R&D skills), (3) nature of NP idea, (inc. whether technical solution and market demand for spec. were clear at start), (4) launch effort, (inc. focussed sales effort, adequate production volume, strong sales effort), (5) general characteristics, (inc. technology level of product, custom product or not, innovativeness to market).

Parry and Song (1994) (JPIM) – n=258, China, almost all state-owned organisations and with industrial products

• Definitions	Implicitly Cooper 1979, this is a replication study.
• Method	Mail survey of managers. See Cooper 1979. t-tests.
• Key findings	(1) *relative product advantage*, (2) product idea was market generated, (3) newness of production process to firm(-), (4) competitive intensity(-), (5) proficiency of development activity, (6) market size and potential, (7) information acquired, (8) proficiency of launch, (9) fit with company skills, (10) product characteristics.

Shenar et al. (2002) (R&DMan) – n=127, Israel, no industry focus

• Definitions	Success is a 13-item construct (goals, benefit to customer, benefit to organisation); NPD defined by SFs on five dimensions, project classified on scales of technological uncertainty and complexity/scope.
• Method	Mail questionnaires to managers. Canonical correlation assessment for critical SFs.
• Key findings	SFs are contingent on project type. High-uncertainty projects: project definition, milestones, design considerations, documentation, policy and customer participation. Low-uncertainty projects: formal selection of contractor, budget monitoring, early design freeze, design for manufacturability, quality objectives, statistical quality control, project manager autonomy. Broad-scope projects: formal bid preparation, early identification of milestones, managerial autonomy, formal contracts, formalised documentation.

Song and Parry (1997a) (JoMR) – n=788, Japan, non-service and publicly listed

• Definitions	Implicitly as per Cooper 1979. Success equates to profitability, marketshare, sales. 12 multi-item constructs capture NPD.
• Method	Mail questionnaire to managers. Positive and negative projects evaluated. Structural equation model, LISREL.
• Key findings	To *product success*: (1) x-functional integration, (2) *product competitive advantage*, (3) competitive and market intelligence, (4) technical proficiency. *To product competitive advantage*: (1) marketing proficiency, (2) technical synergy, (3) marketing synergy.

Song and Parry (1997b) (JoM) – n=612, USA, high-tech

• Definitions	Implicitly as per Cooper 1979. Success equates to profitability, marketshare, sales. 12 multi-item constructs capture NPD.
• Method	Mail questionnaire to managers. Positive and negative projects evaluated. Regressions, structural equation model, LISREL.
• Key findings	Project management: internal commitment, x-functional integration Technical perspective: fit with R&D and marketing Process: business and market opportunity analysis.

Souder et al. (1997) (JPIM) – n=150, USA/NZ, high-tech SMEs

• Definitions	NPD performance is controllable by management. Success is product outcome against expectations.
• Method	Mail questionnaire to managers. Success measured single item, five-point scale. 6 multi-item constructs (four to six items each) rated on five point scales. Factor analysis.
• Key findings	Combined samples: (1) marketing proficiency, (2) technical skills, (3) marketing skills, (4) project manager characteristics, (5) R&D/marketing integration, (6) technical proficiency. But, differences between samples: (1) NZ>USA, (2) not sig., (3) NZ>USA, (4) NZ<USA, (5) NZ>USA, (6) NZ>USA.

Souder and Song (1998) (JPIM) – n=120, Japan and USA, mostly high-tech

- Definitions: NPD climate, expertise and management functions, moderated by high/low market familiarity/ conditions underlie NPD success. 25 factors rated on five-point scale. Success is seven items, four financial, three product-based, on a five-point scale.
- Method: USA was structured interviews; Japan was mail questionnaire. Both with diverse managers. Factor analysis.
- Key findings:

	US HF	US LF	JAP HF	JAP LF
R&D/marketing integration	not sig.	4	4	1
decentralisation	not sig.	1	1	4
sales & marketing expertise	1	2	5	6
technical expertise	not sig.	not sig.	6	4
project manager competence	2	3	3	3
top management involvement	not sig.	5	2	2

Thamhain (1990) (JPIM) – n=52, Geography, high-tech industry

- Definitions: 17 Success is a five-multi-dimensional item construct.
- Method:
- Key findings: Process: team autonomy, experienced and qualified team, team involvement, visibility
  Management: involved and interested, resource allocation
  Strategy: goal and priority setting

Thieme et al. (2003) (JPIM) – n(Japan)=64, n(South Korea)=128, n(∑)= 192), Japan and South Korea, ICT products

- Definitions: NPD is a refined version of Ruekert and Walker (1987) with dimensions of project management, structural/process and outcome. Success is a seven-item construct.
- Method: Interviews with managers, NPD process as defined by SFs for past projects rated. Samples combined to test causal model.
- Key findings: <u>Causal relationships confirmed:</u>
  - participative management style leads to x-functional integration
  - participative management style leads to planning proficiency
  - project manager skills leads to x-functional integration
  - project manager skills leads to planning proficiency (reversed in Japan)
  - senior management support leads to x-functional integration
  - senior management support leads to planning proficiency.
  - x-functional integration leads to process proficiency
  - planning proficiency leads to process proficiency
  - x-functional integration leads to *new product survival* (not significant in Japan)
  - planning proficiency leads to *new product survival*
  - process proficiency leads to *new product survival.*

Zirger and Maidique (1990) (ManSci) – n=172, USA, electronics industry (NB This work follows up and includes data from Maidique and Zirger, 1984, 1985 as seed, but not outcome data.)

- Definitions: Inspired by Lawrence (1969) and Schon (1967) NPD is "change-producing activity that is usually blocked at key transfer points by the tendency at each stage of the process to resist change" (Zirger and Maidique, 1990: p.871). Success equates to financial success.
- Method: Mail questionnaire to senior managers in Fortune 1000 firms. Positive and negative projects reported on 23-item seven-points scales. Factor and discriminant analysis, canonical correlation.

• Key findings	(1) quality of R&D organisation, (2) technical performance of product, (3) *product value to customer*, (4) product synergy with firm resources, (5) management support; also, but less: (6) marketing and manufacturing competence, (7) market competitiveness, (8) size and growth of market.